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Report to the Honorable
J. Robert Kerrey, U.S. Senate

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CROP INSURANCE

Inaccurate FCIC Price Forecasts Increase Program Costs

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Program Evaluation and
Methodology Division

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The Honorable J. Robert Kerrey
United States Senate

Dear Senator Kerrey:

This review is the last of three reports we are providing you concerning the accuracy of U.S. Department of Agriculture (USDA) forecasts. In previous studies, we evaluated the accuracy of USDA's meat and budget commodity forecasts.[1] This study focuses on evaluating (1) the accuracy of the Federal Crop Insurance Corporation's (FCIC's) independent price forecasts, (2) the effect that inaccuracies in these forecasts can have on program costs, and (3) how FCIC can improve its forecast accuracy.

We found that FCIC's corn, wheat, and soybeans price forecasts exhibit large bias errors that exceed those of other available alternative forecasts and that FCIC would have spent about $194 million less than it did if it had used the forecasts made by the World Agricultural Outlook Board (WAOB) over crop years 1983 to 1989.

We identified other forecasting and program cost issues that we believe affect the actuarial soundness of the program. These include (1) forecasts being made earlier in the crop year than necessary, thus leading to potentially larger errors; (2) the lack of an effective management process to evaluate forecast accuracy and methods; (3) the failure to adjust national program price selection options when information on local price variations can be used; and (4) the failure to deduct harvest costs when total crop losses occur.

Background

FCIC is a wholly government-owned corporation offering limited protection for participating farmers against unavoidable losses caused by natural risks, such as drought, flood, insect infestation, and other natural disasters. All farmers are eligible to participate if an insurance program exists for their crop in their county.

The 1980 Crop Insurance Act anticipated that the crop insurance program would operate on an actuarially sound basis. This means that

[1] U.S. General Accounting Office, Short-Term Forecasting: Accuracy of USDA's Meat Forecasts and Estimates, GAO/PEMD-91-16 (Washington, D.C.: May 6, 1991), and USDA Commodity Forecasts: Inaccuracies Found May Lead to Underestimates of Budget Outlays, GAO/PEMD-91-24 (Washington, D.C.: August 13, 1991).

FCIC's premium income should be sufficient to cover all loss claims and to establish a reserve for unforeseen losses.

During the 1980's, the scope of FCIC's insurance program grew dramatically. County crop programs grew from 4,063 in 1979 (covering 29 crops in 39 states) to 21,373 in 1991 (covering 51 crops in 50 states). Program costs were $4.4 billion between crop years 1983 and 1989, of which $2.7 billion were for wheat, corn, and soybeans. These costs were composed of administrative expenses and commissions ($0.9 billion), premium subsidies ($0.8 billion), and losses ($2.7 billion). For crop years 1983 through 1989, total premiums were $3.2 billion (of which $2.0 billion were for wheat, corn, and soybeans) and indemnities were $5.1 billion (of which $3.2 billion were for wheat, corn, and soybeans).

The large disparity between FCIC program indemnities and premiums clearly shows that the program was not able to operate on an actuarially sound basis during the 1980's. Although severe drought and other natural disasters contributed, in part, to excessive program losses, many experts have also noted that serious problems with FCIC's actuary and underwriting services led to high costs as well. An evaluation of the actuarial soundness of FCIC insurance is not the focus of this study; rather, our work addresses the more narrow subject of FCIC price forecast accuracy and cost implications. (Several studies by USDA's Office of Inspector General and others addressing various program cost issues are listed in the bibliography of this report. See also the section entitled "Related GAO Products.")

The Importance of Accurate Forecasts

The World Agricultural Outlook Board has primary responsibility for overseeing the production of USDA commodity supply and demand forecasts and for reviewing analyses prepared by other USDA agencies and offices. However, FCIC prepares price forecasts independently of WAOB. FCIC's actuarial staff prepares initial commodity price forecasts for review by FCIC management. The actuarial staff performs this work on the basis of discussions with, and input from, other USDA analysts and nongovernment commodity analysts. FCIC began using the commodity futures market to forecast the price for soybeans in crop year 1989 and added wheat and corn in crop year 1990.

FCIC's forecasts, which are intended to reflect actual seasonal average market prices for the crop year, provide the basis for the different program price options available to farmers who purchase insurance. Price elections are very important to both FCIC and the insured farmers

because they directly affect the amount of the premium a farmer pays and the amount of indemnity FCIC pays. In addition, the price election affects the private companies selling crop insurance because their commissions are directly related to the amount of premium due from the insured farmers.

If FCIC underestimates crop price elections, then premium payments for farmers will be lower and commissions earned by the reinsurance companies will be reduced. Participation may also be affected by the level of price elections. If farmers perceive price elections as too low, participation may fall off. Farmers may also believe that they have not been adequately compensated by the program if they suffer losses and receive indemnity payments that are lower than actual prices.

If FCIC overestimates price elections, then commissions paid to the reinsurance companies will be higher and indemnity payments made to participants will be higher as well. Overestimated price forecasts may also create greater incentives for morale hazards.[2] However, high price elections may help maintain higher participation levels.

The accuracy of the forecasts can affect the actuarial soundness of each crop insurance program. However, just because the estimated price turns out to be over- or underestimated does not necessarily mean that it will significantly affect program costs. The extent of the financial effect depends upon whether those enrolled in the participating crop insurance program actually experience losses.

Analysis

We addressed three specific evaluation questions:

1. How accurate are FCIC's price forecasts?

2. How do inaccurate forecasts affect FCIC's program costs?

3. How can FCIC improve its forecast accuracy?

To evaluate forecast accuracy, we compared price forecasts to actual seasonal average prices. We examined accuracy by measuring the total and bias error of FCIC and benchmark price forecasts. Total error is the

[2]A morale hazard is a condition in which an absence of incentives to minimize losses occurs once a program participant has a legitimate claim. This can occur when a farmer has a partial loss on a crop and does not try to prevent further loss because the insurance benefits are higher than the receipts from attempts to salvage and harvest the crop. (See the glossary.)

absolute amount that a forecast varies from the actual amount and is composed of both random and bias error. Bias error is systematic overestimation or underestimation of a series of forecasts. (These error measures are discussed in appendix IX.)

Because forecasting is based on an incomplete knowledge about the future, it is to be expected that some level of error will occur. However, total and bias error measures by themselves do not provide a basis for evaluating whether an error is "reasonable." "Reasonable" would imply that errors are small in both total and bias measures and that no better forecasts are readily available. To determine this, it is necessary to compare the forecasts to other available "benchmarks" (for example, competitive forecasts); this helps determine whether smaller error rates are possible.

A benchmark is another forecast for the same variable that can be used for comparison purposes. We used four benchmark forecasts to compare to FCIC's price forecast accuracy: (1) WAOB forecasts made at approximately the same time as FCIC's, (2) FCIC's current futures market methodology applied to historic information, (3) a variation of FCIC's futures market methodology using a lower price level, and (4) the initial forecasts prepared by FCIC's Actuarial and Underwriting Service (A&US). We used the WAOB forecasts because USDA considers them to be its official forecasts.

Findings

FCIC's price forecasts cannot be called reasonably accurate: not only are total and bias error rates large but there are available alternative forecasts that have smaller error rates. Overestimation bias error results in FCIC's paying out excessive insurance indemnities, which may lead to greater morale hazard. Table 1.1 shows the accuracy of the price forecasts we reviewed.

Table 1.1: Price Forecast Accuracy Comparisons Averaged Over Crop Years 1983-89[a]

Forecast	Bias error	Total error
Corn		
FCIC final price	−10.0%	20.9%
A&US recommendation[b]	−3.9	21.0
WAOB forecast	−2.2	24.3
FCIC futures market	−10.0	20.9
GAO futures benchmark	1.6	17.0
Wheat		
FCIC final price	−5.9	20.0
A&US recommendation[b]	0.2	20.4
WAOB forecast	0.7	19.0
FCIC futures market	−6.0	19.9
GAO futures benchmark	7.1	15.7
Soybeans		
FCIC final price	1.8	18.4
A&US recommendation[b]	5.1	19.3
WAOB forecast	2.0	16.6
FCIC futures market	−2.9	18.4
GAO futures benchmark	0.7	16.9

[a]FCIC's high price election.

[b]Staff forecast made prior to FCIC final price forecast.

Source: GAO calculations based on FCIC forecasts and actual data published in World Agricultural Supply and Demand Estimates.

Accuracy of FCIC's Price Forecasts

As shown in table 1.1, FCIC's total error (measured by mean absolute percentage error) ranged from 18.4 percent for soybeans to 20.9 percent for corn. The bias errors (measured by mean percentage error) show that FCIC forecasts for corn were overestimated by an average of 10 percent and for wheat by about 6 percent, while soybeans were underestimated by about 2 percent.

The FCIC final price forecasts for wheat and corn during crop years 1983-89 are less accurate than alternative benchmarks with respect to bias error measures. The initial FCIC forecasts, prepared by A&US, and the WAOB forecasts exhibit lower bias error for corn and wheat compared to the FCIC final price forecasts. Also, our alternative futures market forecasts exhibited lower bias error rates for corn and soybeans than the FCIC price forecasts. Conversely, forecasts using FCIC's futures market methodology were essentially the same for corn and wheat and slightly

higher for soybeans compared to FCIC's price forecasts. FCIC's final soybeans forecasts exhibited similar bias error and total error rates to WAOB's, the FCIC futures market, and our futures market benchmark forecasts. (See appendix III.)

Forecast Implications for FCIC's Program Costs

We estimated program cost implications for corn, wheat, and soybeans, using the alternative benchmark forecasts. We used program premium and cost information included in FCIC's experience data base. We first calculated program costs for crop years 1983 to 1989 and then estimated what program costs would have been, holding other factors such as participation rates constant, if different price forecasts had been used. We found that (1) if WAOB price forecasts had been substituted for FCIC forecasts in crop years 1983 to 1989, the program would have cost $194 million less; (2) if FCIC had used its current methodology for futures market forecasts, program costs might have been $54 million more; and (3) if FCIC had used the initial forecasts prepared by A&US, program costs would have been $167 million less. (See appendix IV.) FCIC officials stated that WAOB is currently restricted by administrative regulations from publicly releasing commodity supply and demand forecasts prior to the president's annual budget submission in January. This restriction may limit FCIC's ability to use WAOB's forecasts, since FCIC forecasts are issued (and available to program applicants) before the president's budget submission date. We inquired about the applicability of this restriction, but we have not been informed about any USDA decisions regarding this matter. We believe, however, that the matter should be resolved and, to the extent possible, FCIC should use the WAOB forecasts because they have been shown to be more accurate than its own forecasts.

We also believe that FCIC management should rely more on the initial forecasts prepared by A&US. During the period of our analysis, we found that FCIC management had changed more than half of the A&US forecasts, which resulted in higher price elections and larger forecast errors. FCIC management provided no justification for these changes.

Currently, FCIC makes forecasts up to 9 months prior to the crop year insurance sales closing date, and most farmers do not purchase insurance until the end of the sales period. We believe that forecast accuracy could be improved if FCIC made its forecasts later in the year. In our previous studies of USDA commodity forecasts, we found that there is a tendency for price forecast errors to increase as the time period between forecasts and actual prices increased.

FCIC now forecasts a national average price for each crop. Yet the actual prices farmers receive fluctuate by region of the country. USDA's Agricultural Stabilization and Conservation Service (ASCS) has established differentials for many of the program crops to account for local differences in grain prices. ASCS data show that regional prices may vary above or below average prices by as much as 20 percent. FCIC could improve the accuracy of its forecasts by using the available ASCS price differentials. FCIC national average price elections may discourage participation by producers who can expect to receive prices that are above average and may create morale hazards where prices are below average.

Finally, our review of FCIC's forecasting indicates the lack of an effective management process to evaluate accuracy and methods—that is, to identify sources of forecasting error, maintain data records, and document and validate forecasting methods. In addition, for many specialty crops, there is no means available to assess accuracy because information on actual prices is not routinely collected. As we have noted in past reports, a management process that includes evaluative capability is essential for ensuring that reasonably accurate forecasts are made.

Other Factors That Affect Program Costs

If farmers suffer a total crop loss and there is no crop to harvest, the indemnity payments they receive still cover some portion of anticipated harvesting costs. A USDA Office of Inspector General report found that up to 5 percent of the cost of the FCIC program could be saved if, for total losses, the harvest costs were deducted. The exact amount is subject to debate because of insufficient harvest cost and total loss acreage information, but savings are possible.

Recommendations

We recommend that the Manager for FCIC

- to the extent possible, use available WAOB crop price forecasts because they have been shown to be more accurate;
- determine the feasibility of using or making forecasts prepared later in the year, closer to the insurance closing date;
- use price differentials for any crop where available;
- implement a stronger forecast management process; and
- develop a more effective method for deducting harvest costs for participants who have total losses yet do not have to harvest a crop.

We recommend that the Secretary of Agriculture direct the Assistant Secretary for Economics to assess the cost-effectiveness of conducting

additional forecasts and determining actual crop prices on specialty crops for which such information is currently not available. We further recommend that WAOB make the forecasts, and the National Agricultural Statistics Service prepare actual seasonal average prices for crops that FCIC insures.

FCIC lost $2.7 billion during crop years 1983-89, or about $391 million annually. Some combination of increased revenues from producer premiums and lower program costs will be needed to reduce these losses to an actuarially sound level. While we believe that our recommendations can help close the gap, sizable losses will clearly remain. As shown in table 1.2, the potential cost savings associated with our recommendations could lead to an estimated reduction in annual losses of $32 to $66 million, which amounts to 8 to 17 percent of the total. We believe that further savings may be identified through a review of FCIC's actuarial and underwriting services functions.

Table 1.2: Potential Cost Savings Associated With GAO's Recommendations

Description	Cost savings[a] Annual	CY 1983-89
Historic losses	$391.1	$2,737.9
Potential savings		
Use WAOB forecasts	27.7	194.0
Shorten forecast time period	[b]	[b]
Deduct harvest cost (range)	4.0–38.0	28.0–266.0
Use ASCS price differentials	[b]	[b]
Forecast management process	[b]	[b]
Total potential savings (range)	31.7–65.7	222.0–460.0
Savings compared to historic losses (range)	8–17%	8–17%

[a]In millions of current dollars.

[b]Potential savings not quantifiable.

Source: The potential savings are discussed in appendixes IV and V.

Our estimated cost savings are conservative for two reasons. First, we evaluated three crops (corn, wheat, and soybeans) that represent about 60 percent of FCIC's coverage. Since our recommendations apply to all crops that are insured, savings may be higher. Second, several of our recommendations—improving forecast management, using a shorter forecast time period, and using ASCS price differentials—have no quantifiable cost effect. We believe, however, that these improvements can result in additional, but unspecified, savings.

Agency Comments

FCIC and other USDA officials reviewed a draft of this report and concurred with our main findings and recommendations pertaining to crop insurance price forecasts. USDA did not agree with our recommendation pertaining to the development of a more effective method for deducting harvest costs. FCIC noted that its current method for determining crop insurance losses takes into account "appraised production . . . when the producer decides not to harvest a crop with little yield" and that this is the "best understood insurance practice" available. (See appendix X.) FCIC, however, applies its method for deducting such costs not to all insured crops but only to some among them. We believe that high harvesting costs are associated with other crops that FCIC insures as well. Therefore, we are not persuaded by this argument and believe that FCIC should study how harvesting costs could be effectively handled with respect to all insured crops.

Additional comments provided by USDA officials are incorporated, where appropriate, into the body of the report.

As agreed with your office, unless you publicly announce its contents earlier, we plan no further distribution of this report until 30 days from the date of this letter. We will then send copies to those who are interested and make copies available to others upon request.

If you have any questions or would like additional information, please call me at (202) 275-1854 or Kwai-Cheung Chan, Director of Program Evaluation in Physical Systems Areas, at (202) 275-3092. Other major contributors to this report are listed in appendix XI.

Sincerely yours,

Eleanor Chelimsky
Assistant Comptroller General

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Figures

Abbreviations

ASCS	Agricultural Stabilization and Conservation Service
A&US	Actuarial and Underwriting Service
CY	Crop year
ERS	Economic Research Service
FCIC	Federal Crop Insurance Corporation
GAO	U.S. General Accounting Office
NASS	National Agricultural Statistics Service
OMB	Office of Management and Budget
USDA	U.S. Department of Agriculture
WAOB	World Agricultural Outlook Board

Background

The Federal Crop Insurance Corporation is a wholly government-owned corporation that offers protection for participating farmers against unavoidable losses caused by natural risks, such as drought, flood, insect infestation, and other natural disasters. All farmers are eligible to participate in the program. However, not all crops are covered and insurance is not available in every county.

The Federal Crop Insurance Act of 1980 (Public Law 96-365) anticipates that the crop insurance program will operate on an actuarially sound basis. This means that FCIC's premium income should be sufficient to cover all loss claims and establish a reserve for unforeseen losses.[1] A study by Nesterczuk and Associates defines actuarially sufficient as breaking even on a national basis over a 10-year period 85 percent of the time, excluding losses attributable to catastrophe. The fiscal year 1991 House report called for continuation of the FCIC program if at least 75 percent of it is actuarially sound.[2]

During the 1980's, the scope of FCIC's insurance program grew dramatically. The number of county crop programs increased from 4,063 in 1979 (covering 29 crops in 39 states) to 21,373 in 1991 (covering 51 crops in 50 states).[3] This growth, as shown in table I.1, was associated with a considerable increase in program costs.[4] Program costs were $4.4 billion between crop years 1983 and 1989. These costs were composed of reinsurance administrative expenses and commissions to crop insurance agents ($0.9 billion), premium subsidies ($0.8 billion), and losses ($2.7 billion).[5] For crop years 1983 through 1989, total premiums were $3.2 billion and indemnities were $5.1 billion. The large and consistent gap each year between premiums and indemnities (except in crop year 1987) clearly shows that the legislative expectation for the program to operate on an actuarially sound basis has not been met.

[1]U.S. General Accounting office, Crop Insurance: Federal Crop Insurance Corporation Needs to Improve Decision Making, GAO/RCED-87-77 (Washington, D.C.: July 23, 1987), p. 14.

[2]House of Representatives, Rural Development, Agriculture, and Related Agencies Appropriations Bill, 1991, Report 101-907, Washington, D.C., October 20, 1990, p. 21.

[3]The total number of county crop programs is the sum of the number of crops covered in each county. See appendix VII for information on crop program growth.

[4]Program costs include reinsurance administrative expenses, master marketer commission fees, federal producer premium subsidies, and indemnities less producers' premiums.

[5]Program costs vary dramatically by crop and state. Tables showing total liabilities, premiums, subsidies, indemnities, and loss ratios by type of crop and state are provided in appendix VIII.

Table I.1: Experience Data Base Cost Information for All Crops Crop Years 1983-89[a]

	1983	1984	1985	1986	1987	1988	1989	Total
Total premiums	$285.8	$433.9	$439.8	$379.4	$364.6	$436.7	$815.6	$3,155.7
Indemnities	$583.7	$638.3	$683.1	$615.2	$369.7	$1,063.5	$1,189.2	$5,142.7
Calculated loss ratio[b]	2.04	1.47	1.55	1.62	1.01	2.44	1.46	1.63
Program costs[c] Losses[d]	$361.6	$302.7	$343.4	$323.8	$92.6	$734.91	$578.8	$2,737.9
Premium subsidies	63.7	98.3	100.1	88.0	87.5	108.07	205.3	750.9
Reinsurance administrative expenses	35.3	85.4	102.9	102.1	106.5	138.40	263.6	834.2
Master marketer commission fees	22.8	21.5	16.0	11.4	9.9	11.09	18.1	110.7
Total program costs	$483.4	$507.8	$562.4	$525.2	$296.5	$992.47	$1,065.8	$4,433.7

[a]Dollars in millions. See appendix II for discussion of reliability assessment for FCIC's experience data base. Totals do not add because of rounding.

[b]Loss ratio is the indemnities divided by the total premiums. Loss ratios in excess of 1.0 indicate premiums are less than indemnities.

[c]Expenses such as FCIC salaries, interest, and claims adjustments are not included.

[d]Losses are defined as indemnities less total premiums and less producers' subsidies.

Source: FCIC experience data base. FCIC maintains a data base by crop year of all insurance policy sales and experience. Crop year data are necessary for actuarial analyses of crop, area, and individual policies.

Crop insurance premiums and indemnities for the three largest insured crops—corn, wheat, and soybeans—were $2.0 and $3.2 billion, respectively, during crop years 1983-89. Table I.2 shows program costs for these crops, as well as program costs for all crops.

Table I.2: Program Costs for Wheat, Corn, Soybeans, and Total for All Crops Crop Years 1983-89[a]

				Total	
Crop year	Corn	Wheat	Soybeans	3 crops	All crops
1983	$92	$30	$149	$271	$483
1984	56	93	154	303	508
1985	30	196	128	355	562
1986	55	99	127	280	525
1987	26	44	81	151	297
1988	276	283	138	697	992
1989	190	290	115	595	1,066
Total	**$725**	**$1,035**	**$892**	**$2,652**	**$4,433**

[a]Dollars in millions.

Table I.3 shows the loss ratios for corn, wheat, and soybeans during 1983-89. The loss ratio is the indemnity paid divided by the total premium. Soybeans and wheat consistently exhibited high loss ratios during this time period. Corn exhibited high loss ratios in the drought years of 1983 and 1988.

Table I.3: Loss Ratios for Corn, Wheat, and Soybeans Crop Years 1983-89

Crop year	Corn	Wheat	Soybeans	All crop total
1983	2.74	0.88	2.49	2.04
1984	0.89	1.60	1.90	1.47
1985	0.62	2.47	1.73	1.55
1986	0.83	1.71	2.04	1.62
1987	0.59	1.03	1.32	1.01
1988	3.20	3.96	1.94	2.44
1989	0.90	2.27	0.95	1.46
Average	1.40	1.99	1.77	1.63

How the Program Works

During the period of our review, farmers purchasing crop insurance selected one of three different price options and one of three different coverage levels. Before the planting season, FCIC established a high, medium, and low price election for each crop. FCIC was required by law to have one price election that approximates but is not less than 90 percent of the forecast market price. During the 1980's, FCIC used 100 percent of the forecast market price for the high price election on the three largest crops. The medium and low price elections were set at about 83 percent and 67 percent, respectively, of the high price election. About 95 percent of the federal program costs during crop years 1983 to 1989 were associated with the high price election.

FCIC insures farmers against a certain amount of lost production in bushels or pounds per acre. During the 1980's, participants could select one of three yield coverage levels—50, 65, or 75 percent. Yields are based on a farmer's actual 10-year production history.[6] During crop years 1988 and 1989, about 38 percent of program participants selected the high yield coverage level, 60 percent selected the medium yield level, and 2 percent selected the low yield level.

[6]U.S. General Accounting Office, Crop Insurance: FCIC Should Strengthen Actual Production History Program Controls, GAO/RCED-89-19 (Washington, D.C.: December 15, 1988).

A producer's premium per acre is calculated by multiplying the farmer's yield by the yield coverage level selected by the price election by the premium rate by the share. Insurance premium rates vary depending upon such factors as the coverage chosen, the crop, previous loss experience, and the location of the farm. The share is obtained by multiplying the percentage interest the insured has in the crop. FCIC subsidizes up to 30 percent of the premium.

To understand how crop insurance operates, assume that a farmer with an average yield of 100 bushels of corn per acre selects the 75-percent coverage option and a $2 per bushel price election. If a disaster occurs and the yield drops to 25 bushels per acre, the farmer would have an insured loss of 50 bushels (75 percent of 100 bushels less the 25 bushels actually produced). FCIC would pay the farmer $100 ($2 x 50 bushels) for each acre insured.

Recently, FCIC program procedures were modified to allow a price election based on futures markets. In crop year 1989 for soybeans, and in crop year 1990 for wheat and corn, the high price election became the medium price election, and a price election based on the futures market became the high price election (referred to as the market price election). Subsequently, the medium election became the low and the low price election was dropped. The futures market price election, which is estimated at a later date, can go no lower than the former high price election. For crop year 1990, FCIC officials estimated that about 25 percent of all the insurance sold was at the futures market based price election.

The Food, Agriculture, Conservation and Trade Act of 1990 (Public Law 101-624) requires that beginning in crop year 1992, the price level for each commodity on which insurance is offered not be less than the projected market price as determined by FCIC. Insurance coverage is to be available to the producer on the basis of any election that equals or is less than the price established by FCIC. While this procedure allows for many more price options, the maximum is still 100 percent.

The Importance of Accurate Forecasts

The price election is very important both to FCIC and to the insured farmers because it directly affects the amount of the premium a farmer pays and the amount of indemnity FCIC pays. In addition, the price election affects the reinsured companies and master marketers selling crop insurance because their commissions are directly related to the amount of premium due from the insured farmer.

If FCIC underestimates crop price elections, then premium payments for farmers will be lower and commissions earned by the reinsurance companies will be reduced. Participation may also be affected by the level of price elections. If farmers perceive price elections as too low, participation may fall off. If farmers suffer crop losses and receive indemnity payments and the price elections underestimate actual crop price, farmers will believe that they have not been adequately compensated by the program.

If FCIC overestimates price elections, then commissions paid to the reinsured companies and master marketers will be higher and indemnity payments made to participants will be higher as well. Overestimated price forecasts may also contribute to morale hazard. However, high price elections may help maintain higher participation levels.

Although the accuracy of the price forecasts can affect the actuarial soundness of each crop insurance program, an over- or underestimated forecast alone does not necessarily affect program costs. Any financial effect will depend upon whether participants enrolled in the crop insurance program experience losses.

The FCIC Price Election Process

Several factors go into determining when to set a price election. Many producers want to know the amount of protection and premium cost before a legal debt exists. Often lenders require this information as part of the financial plan for the coming production season. In order to minimize adverse selection problems, the price election should be set before anyone can judge the crop potential for a season.[7] FCIC concluded that the price election should be available to the producer at least 4 to 6 months before planting.[8]

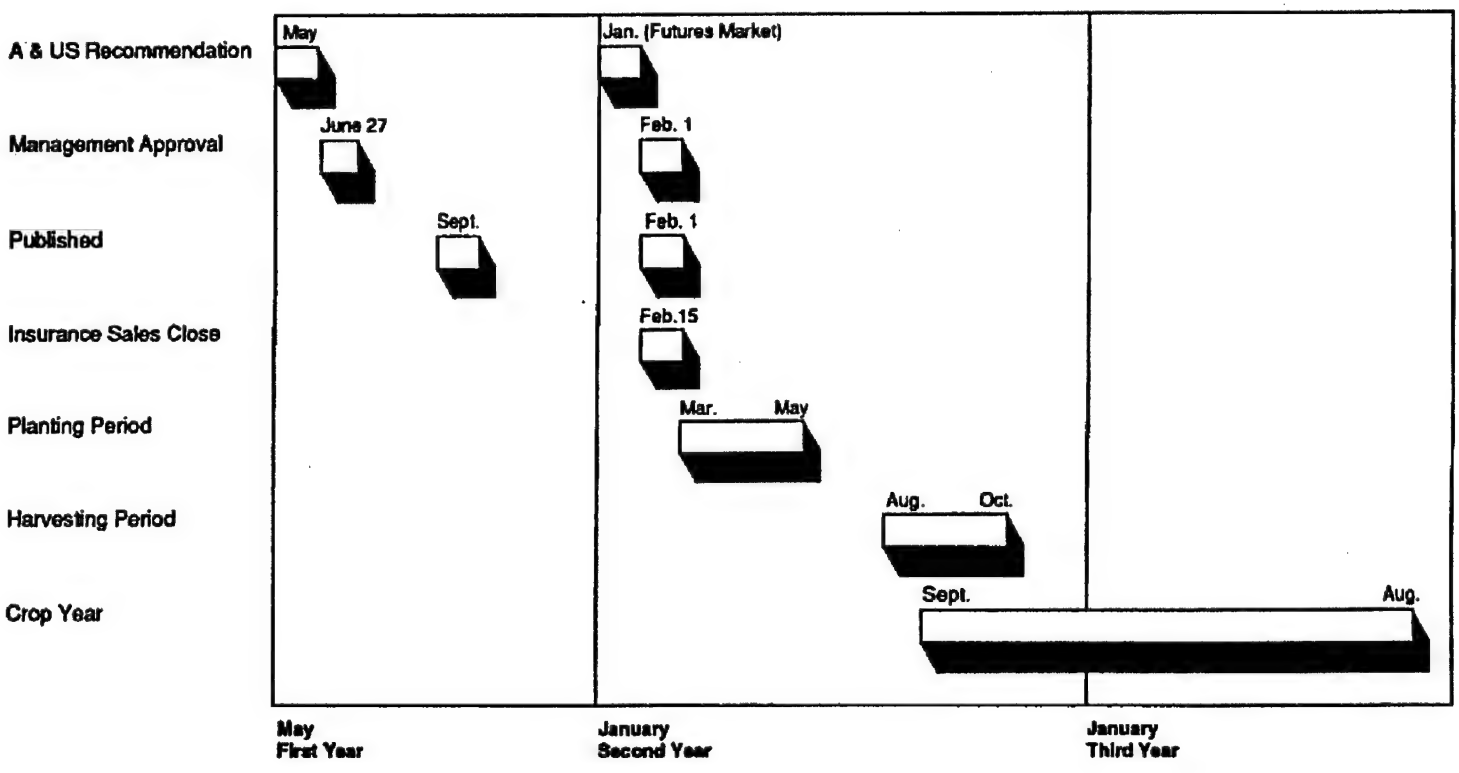
FCIC began setting price elections after the 1980 Federal Crop Insurance Act directed that the highest price election be no lower than 90 percent of the projected market price. USDA's World Agricultural Outlook Board has primary responsibility for overseeing the completion of USDA commodity supply and demand forecasts and for reviewing forecasts prepared by other USDA offices. FCIC prepares its forecasts, however,

[7]Adverse selection is a condition in which certain farmers participating in the program may be more likely to experience losses than other farmers. That is, some farmers who consistently produce lower yields than average may be more likely to purchase insurance than farmers who do better than average.

[8]FCIC, Actuarial Services Division, "Price Election Process," Washington, D.C., February 28, 1990, p. 3.

independently of WAOB. FCIC establishes price elections by calling personnel from WAOB, Economic Research Service, other government agencies, private forecasters, grain exporters, and university researchers to obtain information on expected prices. FCIC A&US staff then recommend price elections to management in Washington, D.C. FCIC management may change these election recommendations. The Office of Management and Budget (OMB) also reviews any price elections prior to their public release because of past concerns about arbitrarily determined price elections. Figure I.1 shows the dates for the corn price forecasting process.

Figure I.1: Crop Year 1990 Decision Dates for FCIC's Corn Price Election Process



Source: Forecast information from FCIC, A&US. Planting and harvesting dates from USDA Statistical Reporting Service, Usual Planting and Harvesting Dates for U.S. Field Crops, Agricultural Handbook 628 (Washington, D.C.: April 1984).

As figure I.1 indicates, FCIC makes its price election recommendations more than 1 year before harvesting actually begins. FCIC's futures market-based price elections are made about 7 months prior to the harvest. The Commission for the Improvement of the Federal Crop Insurance Program recommended that all information concerning policies be released by an early date.[9] The commission also recommended, however, that the maximum price election be announced no later than 60 days before sales closure.[10] An A&US official said efforts have been made to publish forecasts by July 1 for spring-planted crops, but this would affect forecast accuracy.

In our previous studies of USDA commodity forecasts, we found that as the time periods increase, forecast errors tend to increase.[11] We believe this is a typical finding and can be expected since the shorter the forecast period is the fewer are the events that can affect forecast results.

In 1983, FCIC first considered using the futures market to test alternative forecast methods to get more reliable prices and more timely price elections. The 1989 commission report recommended that FCIC consider a futures market alternative.[12] OMB expressed concern about the accuracy of the futures market but allowed FCIC to use it.

FCIC continues to recommend price elections that are 100 percent of the projected market price but now uses these estimates for the medium price election. FCIC uses the futures market to determine a market price election that becomes the high price election, if the result is higher than the medium price election. If FCIC's futures market price election is lower than the medium price election, FCIC's medium price election becomes both the medium and high price elections.

In crop year 1989, FCIC offered futures market-based price elections for soybeans for the first time. However, FCIC refined its methodology in crop year 1990 and added corn and wheat. In crop year 1991, FCIC issued futures market price elections for 11 crops: corn, corn silage,

[9]Commission for the Improvement of the Federal Crop Insurance Program, Interim Report (Washington, D.C.: April 3, 1989), p. 7.

[10]Commission for the Improvement of the Federal Crop Insurance Program, Findings and Recommendations (Washington, D.C.: July 1989), p. 48.

[11]U.S. General Accounting Office, USDA Commodity Forecasts: Inaccuracies Found May Lead to Underestimates of Budget Outlays, GAO/PEMD-91-24 (Washington, D.C.: August 13, 1991).

[12]Commission, Findings and Recommendations, p. 48.

hybrid corn-seed, feed barley, malting barley, grain sorghum, hybrid sorghum-seed, oats, rye, soybeans, and wheat. FCIC currently has no plans for issuing futures market-based price elections for other crops.[13] Most other FCIC-insured crops are not traded on the futures market, nor do they have any consistent relationship to prices of traded commodities.

Past Studies on Forecasting Issues

While we found no studies that quantify the effect of inaccurate price elections on FCIC's losses, many studies and administrative and legislative actions address the forecast issues identified in this report. The Commission for the Improvement of the Federal Crop Insurance Program recommended—and the Food, Agriculture, Conservation, and Trade Act of 1990 provided—that the high price election be set at 100 percent of the forecast seasonal average price. Further, the commission recommended that futures prices be used whenever possible to provide the most recent price data and that price elections that accurately reflect local prices be used.[14] A 1989 Congressional Research Service review of the commission's recommendations noted, however, that the commission did not include estimates of the costs associated with its proposed reforms.[15]

Milliman and Robertson studied concerns about overestimated price forecasts.[16] They found that a significant morale hazard does exist for insureds in a loss situation under the current price election system, but major changes in the indemnification or rating procedures for all-risk coverage are not warranted. They recommended that attempts be made to control possible abuse through the loss adjustment process. Further, they stated that a potential for morale hazard exists when price elections exceed actual prices available to producers. Their study assumed price levels were forecast at 90 percent of seasonal average price.

[13]Data exist for making futures market price forecasts for cotton, peanuts, rice, safflowers, sunflowers, and tobacco.

[14]Commission, Findings and Recommendations, page 47 for the 100 percent price election recommendation, page 49 for the use of futures prices, and page 23 for information on local prices.

[15]Ralph M. Chite, Crop Insurance Reform: A Review of the Commission Recommendations (Washington, D.C.: Congressional Research Service, November 20, 1989), p. 9.

[16]Milliman and Robertson, Inc., "Actuarial Analysis of Multiple Peril Crop Insurance," study prepared for USDA, Federal Crop Insurance Corporation, Kansas City, Missouri, January 4, 1984, p. 15.

Hill found that forecast accuracy is important to minimize political pressure for changing price elections.[17] Increases in price elections may increase costs. For the 10 crops analyzed, Hill found that FCIC overestimated prices approximately 67 percent of the time. Hill concluded that FCIC should continue to base its price election options on 100 percent of the price forecast but that forecast performance could be improved by increasing the resources associated with the forecast process.

Nesterczuk found that price forecasting is important because the indemnity received by the producer is directly determined by the price election.[18] Furthermore, producer participation in the insurance program is influenced by perceptions of the accuracy of FCIC's price elections.

[17]Walt Hill, "Analysis of the Federal Crop Insurance Corporation Price Election Procedure," report to the Federal Crop Insurance Corporation Manager, Washington, D.C., January 12, 1990, p. 12.

[18]Nesterczuk and Associates, "Reforming Federal Crop Insurance: A New Approach to Risk Distribution," report to the Federal Crop Insurance Corporation Manager, Washington, D.C., December 15, 1989, p. 9.

Objectives, Scope, and Methodology

Objectives

We developed the following general evaluation questions to address Senator Kerrey's concerns about the accuracy of FCIC's price forecasts:

1. How accurate are FCIC's price forecasts?

2. How do inaccurate forecasts affect FCIC's program costs?

3. How can FCIC improve its forecast accuracy?

Scope

We reviewed corn, wheat, and soybeans for crop years 1983 to 1989. WAOB makes forecasts for these commodities. They are the largest insured crops, accounting for 60 percent of all FCIC program costs during 1983-89. While our findings for these crops cannot be projected to others, an FCIC official said the issues we identify apply to other crops as well. Our evaluation of the accuracy of FCIC's forecasts was limited to 1983-89 because data documenting forecasts prior to 1983 were incomplete and no actual price information was available after 1989.

We used FCIC's experience data base to price out the cost implications of inaccurate forecasts. We did not complete a reliability assessment of that data base.[1]

We were unable to review the accuracy of FCIC's current futures market methodology because actual seasonal average prices were not available for the 1990 crop year at the time of our review. However, we conducted a retrospective analysis to determine what the accuracy of FCIC forecasts would have been for crop years 1983 to 1989 had FCIC used its futures market methodology. We believe the results of this analysis provide an indicator of the potential accuracy of FCIC's futures market methodology. Since FCIC considers its futures market price forecasting methodology to be administratively confidential, we do not describe it.

Price forecasts are only part of the process for determining a farmer's coverage. Price forecasts, therefore, can only explain part of FCIC's program costs. Other factors that can also affect the program costs, such as

[1]Our preliminary reliability assessment indicates that differences between FCIC's experience data base and FCIC's financial reports are quite small. Table I.1 shows crop year data for FCIC for the period evaluated. Data reported in the experience data base differ from those used in FCIC's financial reports. While the results are similar, the financial data are reported by fiscal year and contain more than one crop year. Crop year 1983 to 1989 premium income exceeds fiscal year 1983 to 1989 reports by 0.5 percent, understates indemnities by about 5 percent, and understates net losses by about 15 percent.

a farmer's yield, loss adjustment procedures, and premium rates, were not considered.

The appropriateness of FCIC's forecast methodology can be evaluated in two ways. One is to verify that the methods accurately reflect the relationships of such factors as farmers' participation, market prices, supply, and demand. The second is to evaluate the forecast results by measuring historical accuracy and by comparing that accuracy to results from other methods. In this evaluation, we concentrate on measuring forecast accuracy. We did not systematically evaluate all aspects of FCIC's processes.

Methodology

To evaluate FCIC's forecast accuracy, we first compared price forecasts to actual seasonal average prices. Second, we developed benchmarks and compared them to the FCIC forecasts. Third, we assessed what the effects on crop insurance program costs would be for crop years 1983 to 1989 under alternative forecasts. Finally, to determine where improvements could be made, we reviewed the forecast management process FCIC uses for its crops.

Accuracy Measures

To evaluate FCIC's forecast accuracy, we reviewed literature and interviewed knowledgeable USDA analysts to develop an understanding of FCIC's process for making commodity price forecasts. To measure the accuracy of FCIC's forecasts for corn, wheat, and soybeans, we compared each forecast with actual data from WAOB's monthly publication, the World Agricultural Supply and Demand Estimates, and we identified two principal error measures—total error and bias error. Forecast errors can be separated into two components: random (unsystematic) error and bias (systematic) error. We measured total error using mean absolute percentage error and measured bias error using mean percentage error.

We used other total and bias error measures such as adjusted mean absolute percentage error and a root mean squared percentage error. Alternative bias error measures we used were a trimmed mean percentage error and a weighted mean percentage error.[2] Error measures

[2]The results from using these error measures, which are not included in this report, are similar to those found using mean absolute percentage error and mean percentage error.

are discussed in appendix IX. More extensive discussions of forecast accuracy measures are included in previous reports.[3]

Benchmark Comparisons

Because forecasting is based on incomplete knowledge about the future, it is expected that some level of error will occur. However, total error and bias error measures by themselves do not provide a basis for evaluating whether an error is "reasonable." "Reasonable" would imply both small total and bias errors and that no better forecasts are readily available. To determine this, it is also necessary to compare them to other available "benchmarks" (that is, competitive forecasts) as a way of determining whether smaller error rates are possible.

We compared FCIC's forecasts to WAOB forecasts, forecasts we generated using FCIC's futures market methodology, and forecasts based on a futures market methodology we developed. Our benchmark uses the same methodology as FCIC but allows for a lower price than FCIC, which, under current administrative procedures, is set no lower than the middle forecasted price level. We obtained actual corn, wheat, and soybeans seasonal average prices from World Agricultural Supply and Demand Estimates and the Economic Research Service. We discuss benchmark accuracy comparisons in appendix III.

Program Cost Implications

To determine program cost implications, we applied alternative price forecasts to actual FCIC program cost and premium data for crop years 1983 to 1989. The method for estimating costs is explained and the results of our analysis using alternative forecasts are discussed in appendixes IV and VII. We also identified a number of other forecast-related matters that can affect program costs such as the use of local price differentials and the deduction of harvest costs in cases in which total crop loss occurs. These issues are discussed in appendix V.

[3]See U.S. General Accounting Office, Short Term Forecasting: Accuracy of USDA's Meat Forecasts and Estimates, GAO/PEMD-91-16 (Washington, D.C.: May 6, 1991), and USDA Commodity Forecasts: Inaccuracies Found May Lead to Underestimates of Budget Outlays, GAO/PEMD-91-24 (Washington, D.C.: August 13, 1991).

Options for Improving FCIC's Price Forecasting

In previous forecast evaluations, we developed general criteria for improving the process for managing forecasts.[4] These criteria were included in the Food, Agriculture, Conservation, and Trade Act of 1990, and USDA reported that it has begun implementing several forecast management steps to improve commodity program forecast accuracy. We applied these criteria against what FCIC is doing to manage its price forecasts. We also reviewed studies to determine other issues that FCIC could use to improve forecast accuracy. We summarize specific recommendations for improving FCIC's forecasting process in appendix VI.

The written comments that FCIC provided on the draft of this report are presented in appendix X. We conducted our review in accordance with generally accepted government auditing standards during the period December 1990 through March 1991.

[4]See USDA Commodity Forecasts and Short-Term Forecasting: Accuracy of USDA's Forecasts and Estimates of Meat Production, Prices, and Inventories, GAO/PEMD-91-16 (Washington, D.C.: May 6, 1991), and USDA's Commodity Program: The Accuracy of Budget Forecasts, GAO/PEMD-88-8 (Washington, D.C.: April 21, 1988).

Price Forecast Accuracy Results

In this appendix, we respond to evaluation question 1, "How accurate are FCIC's price forecasts?" We assess accuracy by measuring errors (forecast data minus actual data) and using available benchmarks for comparison purposes. We found that FCIC's forecasts for corn, wheat, and soybeans exhibited large errors and were less accurate than alternative benchmarks.

FCIC Forecast Error

For all three crops, FCIC's forecasts exhibited large total errors of 18 to 21 percent. The bias errors show that FCIC's forecasts for corn and wheat overestimated actual prices by -10.0 and -5.9 percent, respectively. For soybeans, FCIC's forecasts underestimated actual prices by 1.8 percent. See table III.1.

Table III.1: FCIC Final Forecast Accuracy Results Crop Years 1983-89[a]

Crop	Bias error	Total error
Corn	−10.0%	20.9%
Wheat	−5.9	20.0
Soybeans	1.8	18.4

[a]Sample size of 7 years, one forecast for each crop year.

Source: GAO calculations based on FCIC forecasts and actual data from World Agricultural Supply and Demand Estimates.

Benchmark Comparisons to FCIC's Forecasts

We analyzed five sets of price forecasts: the initial recommendations made by A&US, the final FCIC forecasts, WAOB forecasts, FCIC's futures market forecasts, and our own alternative futures market forecasts. The WAOB forecasts were used as benchmarks because they are made when FCIC makes its forecasts and WAOB has chief responsibility for preparing USDA's official supply and utilization forecasts. We used A&US price recommendations because they represent FCIC's initial price forecasts without management intervention. We developed FCIC's futures market forecasts into benchmarks because FCIC's objective for using them is to enhance forecast accuracy. We also used an alternative futures market forecast methodology to illustrate another application of futures market data. Overall, as table III.2 indicates, the alternative benchmarks in most cases showed improved accuracy over FCIC's original forecasts.

Table III.2: Benchmark Accuracy Results for Corn, Wheat, and Soybeans Crop Years 1983-89[a]

Forecast	Bias error	Total error
Corn		
FCIC final price	−10.0%	20.9%
A&US recommendation[b]	−3.9	21.0
WAOB forecast	−2.2	24.3
FCIC futures market	−10.0	20.9
GAO futures benchmark	1.6	17.0
Wheat		
FCIC final price	−5.9	20.0
A&US recommendation[b]	0.2	20.4
WAOB forecast	0.7	19.0
FCIC futures market	−6.0	19.9
GAO futures benchmark	7.1	15.7
Soybeans		
FCIC final price	1.8	18.4
A&US recommendation[b]	5.1	19.3
WAOB forecast	2.0	16.6
FCIC futures market	−2.9	18.4
GAO futures benchmark	0.7	16.9

[a]FCIC's high price election.

[b]Staff forecast made prior to FCIC's final price forecast.

Source: GAO calculations based on FCIC forecasts and actual data from World Agricultural Supply and Demand Estimates.

A&US Recommendations

The A&US recommended price forecasts for wheat and corn exhibited consistently smaller bias and total error compared to FCIC's futures market and final forecasts. However, the A&US soybean forecasts exhibited an underestimation of actual price by 5.1 percent, which is larger than FCIC's futures market and final forecasts.[1] FCIC management changed 12 of a possible 21 A&US price recommendations without justification during the period of our analysis. Of these 12 changes, 5 resulted in lower forecast accuracy, 4 increased prices during drought conditions that resulted in higher indemnity payments, and 3 increased the price to

[1]We conducted tests to assess whether there were statistically significant differences between alternative forecasts and found that the A&US recommended forecasts were significantly lower (at the 95-percent level) than the FCIC final price forecasts for corn and wheat.

a level closer to the actual seasonal average price. All the FCIC management changes to the A&US recommendations resulted in higher price elections.

WAOB Forecasts

WAOB forecasts tended to exhibit smaller bias and similar total error for corn and wheat and about the same level of error for soybeans compared to FCIC's futures market and final forecasts.[2] The bias error of the WAOB forecasts ranged from only 0.7 percent to 2.2 percent. The bias error rates for the FCIC final forecasts were considerably higher than the WAOB forecasts for corn (-10.0 versus -2.2) and wheat (-5.9 versus 0.7) but about the same for soybeans (1.8 versus 2.0). Table III.3 shows the FCIC, A&US, and WAOB forecasts compared to actual data.

[2]Our analysis showed that the WAOB forecasts were significantly different (at the 95-percent level) when compared to the FCIC final price forecasts for wheat.

Table III.3: FCIC, A&US, and WAOB Forecasts for Corn, Wheat, and Soybeans Crop Years 1983-89

Crop	Year	FCIC	A&US	WAOB	Actual
Corn	1983	$2.70	$2.70	$2.80	$3.25
	1984	2.90	2.70	2.65	2.63
	1985	2.85	2.85	2.65	2.23
	1986	2.35	2.35	2.60	1.50
	1987	2.00	1.80	1.85	1.94
	1988	2.00	1.75	1.65	2.54
	1989	2.60	2.25	1.80	2.36
Wheat	1983	4.00	4.00	4.10	3.53
	1984	4.00	4.00	3.55	3.39
	1985	3.75	3.50	3.30	3.08
	1986	3.30	3.05	3.30	2.42
	1987	2.60	2.30	2.45	2.57
	1988	2.60	2.25	2.30	3.72
	1989	3.00	2.90	2.75	3.72
Soybeans	1983	6.00	6.00	6.85	7.81
	1984	6.50	6.50	6.25	5.84
	1985	6.50	6.50	6.35	5.05
	1986	5.25	5.25	5.65	4.78
	1987	5.00	4.55	4.90	5.88
	1988	5.00	4.75	4.80	7.42
	1989	6.17	5.50	5.65	5.70

Source: FCIC forecasts from working documents. WAOB forecasts obtained from president's budget documents for wheat and midsession review budget documents for corn and soybeans. Actual prices from World Agricultural Supply and Demand Estimates.

FCIC's Futures Market Forecast

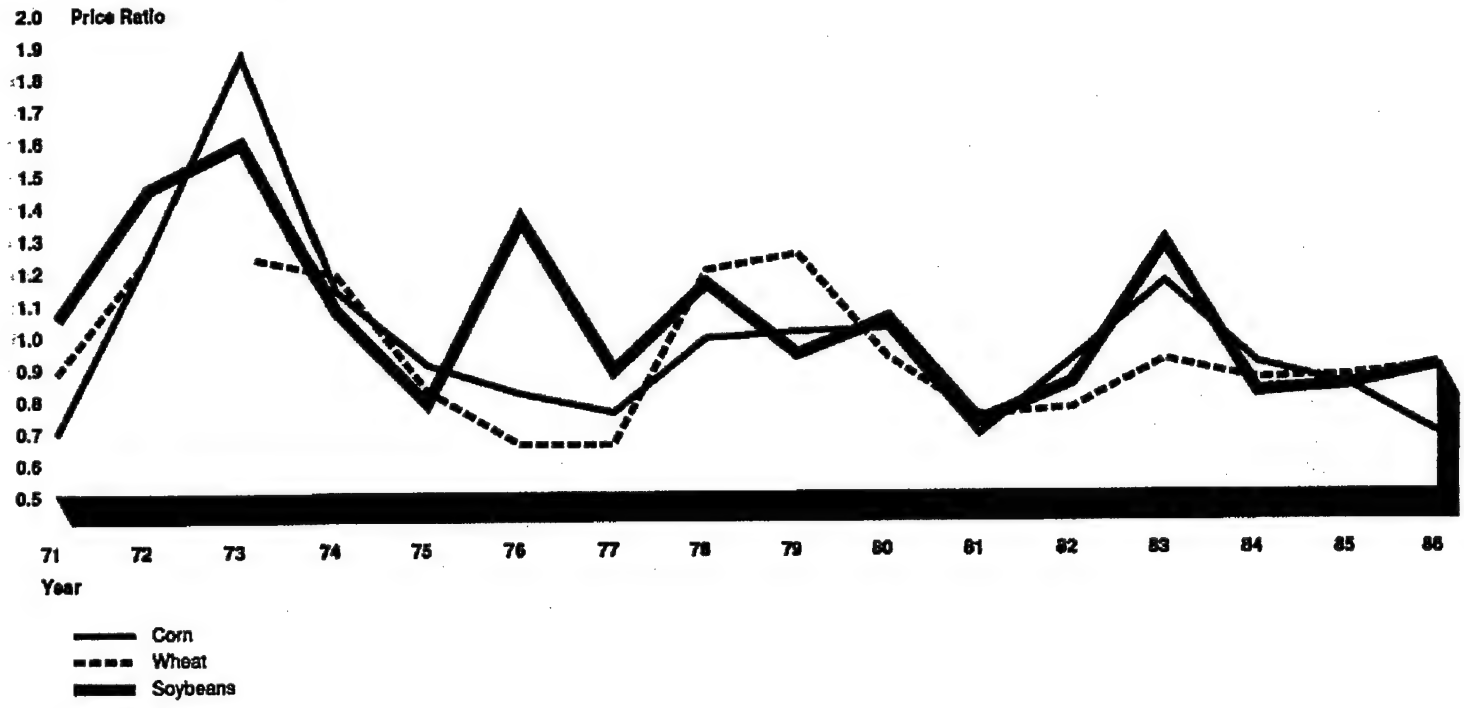
FCIC's futures market forecasts exhibited overestimation bias error for all three crops, ranging from -2.9 percent for soybeans to -10.0 percent for corn. FCIC's futures market forecasts were similar in accuracy to the FCIC final price forecasts except for soybeans.

The fact that FCIC's futures market forecasts did not tend to improve FCIC's original forecast accuracy is not surprising since FCIC's original price was already overestimated and the futures market methodology can only increase the price election. When FCIC analysts began using the futures market, their intent was to formulate a more accurate, market-oriented price election. However, FCIC did not complete any studies on accuracy prior to implementing the futures market price. An OMB official reviewed the methodology and expressed concern over FCIC's use of the

futures market to develop price forecasts but did not require any evaluation of its accuracy prior to its use.

Figure III.1 shows the historical relationship between futures market prices and actual seasonal average prices.[3] This historical relationship has been highly erratic, which demonstrates FCIC's potential for error in attempting to forecast seasonal average prices by using a relationship of historic futures market prices to seasonal average prices.

Figure III.1: Relationship of Futures Market Price and Seasonal Average Price for Corn, Wheat, and Soybeans Crop Years 1971-86[a]



[a]Data missing for wheat for 1972-73.

GAO's Futures Market Benchmark

Our alternative futures market forecasts produced the lowest total error for all three crops. It also produced the lowest bias error for corn and soybeans; however, the bias error rate for wheat was higher than all the

[3]These are the futures market prices from which FCIC makes its forecasts. Additional explanation is restricted since OMB considers FCIC's methodology to be confidential.

other benchmarks. This shows that the futures market could be used but with caution.

Cost Implications

In this appendix, we respond to evaluation question 2, "How do inaccurate forecasts affect FCIC's program costs?" Table IV.1 shows the effect on historical program costs of using alternative forecasts. If FCIC had used the more accurate WAOB forecasts, it would have saved up to $194 million, or 7.3 percent of FCIC's total program costs of $2.7 billion for corn, wheat, and soybeans during crop years 1983 to 1989. If FCIC had used the initial forecasts prepared by A&US, it would have saved up to $167 million. Table IV.1 also shows that FCIC could have incurred additional program costs had it used futures market forecasts using its current methodology.

Table IV.1: Cost Implications of Alternative Forecasts for Corn, Wheat, and Soybeans Crop Years 1983-89

Forecast	Savings (cost)[a]	Percent of 3 crop program costs
WAOB forecast	$194	7.3%
FCIC futures market	(54)	2.0
A&US recommendation	167	6.3

[a]Dollars in millions.

Method for Calculating Program Cost Implications

Using actual FCIC experience data base information, we estimated the effects on historical program costs of using alternative forecasts. Our method for estimating program costs involved calculating FCIC's total program costs for corn, wheat, and soybeans for crop years 1983 to 1989. Total program costs include premium subsidies, administrative expenses, commission fees, and indemnities less producers' premiums.

Then we calculated the program costs FCIC would have incurred, holding all other factors such as participation rates constant, if alternative price forecasts had been used. Since program costs are directly affected by the price election, we used the relationship of the alternative high price election to FCIC's final high price election. This relationship, or adjustment factor, was used to arrive at alternative medium and low price elections. It was then used to recalculate program costs (premium, indemnity, commission fees, and administrative expenses) using the alternative price forecasts.

We used program costs rather than losses because additional costs are associated with the insurance program and are not included in losses. Losses account for only the difference between the premium and the indemnity, but additional costs for a premium subsidy, commission expenses, and administrative fees are based on the price election selected.

Two assumptions associated with our estimation method affect the costs presented. However, we believe that these assumptions tend to be conservative and the effects on program costs quite low. They relate to an assumed linear relationship between price election and program cost variables and the use of the experience data base.

For all our calculations, we assumed a linear relationship between the forecast price election and FCIC's costs. For instance, given a forecast price election and cost, a lower forecasted price election would decrease costs proportionally. Our method does not consider the effect on participation of different price levels. Since most of the price changes are minor, we assumed that participation would not have been altered.

FCIC's experience data base shows crop insurance premiums due as stated in participants' contracts and not necessarily what was actually paid out or received. Our calculations are based on 100 percent of premiums contracted, although 98 percent of premiums were actually collected over the 1983 to 1989 period.

WAOB Benchmark Cost Analysis

Our appendix III analysis demonstrated that WAOB's forecasts were more accurate than FCIC's forecasts. If FCIC had used WAOB's forecasts for crop years 1983 to 1989, FCIC would have saved $194 million in its corn, wheat, and soybean costs. Table IV.2 shows that the WAOB forecasts for corn exhibited the most savings of $106 million, followed by wheat with savings of $93 million.

Table IV.2: Estimated Program Cost Savings Using WAOB Forecasts for Corn, Wheat, and Soybeans Crop Years 1983-89[a]

Crop	FCIC costs	WAOB costs	Savings (cost)
Corn	$725	$619	$106
Wheat	1,035	942	93
Soybeans	892	897	(−5)
Total	**$2,652**	**$2,458**	**$194**

[a]Dollars in millions.

For soybeans, however, the use of WAOB forecasts would have led to an additional loss of $5 million. This additional loss is explained by WAOB's higher underestimation of the soybeans forecasts than FCIC's. Most of the cost effects occurred in drought years because crop losses were greater. Corn and wheat had the highest cost savings during crop years 1988 and 1989. Soybeans had the highest additional costs during crop year 1983.

FCIC Futures Market Benchmark

The use of FCIC's futures market forecasts would have increased FCIC's costs. If FCIC had used its futures market forecasts for crop years 1983 to 1989, it could have incurred $54 million in additional costs. Table IV.3 shows that almost all the additional costs were associated with soybeans.

Table IV.3: Estimated Program Costs Using FCIC Futures Method Forecasts for Corn, Wheat, and Soybeans Crop Years 1983-89[a]

Crop	FCIC costs	FCIC futures costs	Savings (cost)
Corn	$725	$725	$0
Wheat	1,035	1,037	(−2)
Soybeans	892	944	(−52)
Total	**$2,652**	**$2,706**	**$(−54)**

[a]Dollars in millions.

Cost differences were slight for corn and wheat because of FCIC's requirement that the futures market forecast not go below FCIC's final forecast, although it may go above. For corn, FCIC's futures market forecasts were all below FCIC's final forecasts and were not used. For wheat, FCIC used its futures market forecasts only for crop year 1989 and its final forecasts for all other years. For soybeans, 4 of 7 forecasts were higher than the FCIC final forecasts.

A&US Benchmark Cost Analysis

As shown in appendix III, the A&US forecasts were more accurate than FCIC's final forecasts. If FCIC had used the initial A&US recommended forecasts for crop years 1983 to 1989, FCIC would have saved $167 million in costs for the corn, wheat, and soybeans programs. Table IV.4 shows that the A&US forecasts for wheat exhibited the most savings, $73 million, followed by corn with savings of $67 million and soybeans with savings of $27 million.

Table IV.4: Estimated Program Cost Savings Using A&US Forecasts for Corn, Wheat, and Soybeans Crop Years 1983-89[a]

Crop	FCIC costs	A&US costs	Savings
Corn	$725	$659	$67
Wheat	1,035	962	73
Soybeans	892	865	27
Total	**$2,652**	**$2,485**	**$167**

[a]Dollars in millions.

Other Forecast-Related Matters Affecting Costs

We identified several other matters that affect the accuracy of FCIC's forecasting program and increase the potential for additional program costs or reduced participation. While we did not attempt to fully quantify their effects, we believe each may have had a multimillion dollar effect during crop years 1983-89. They include FCIC's

- making forecasts earlier than necessary,
- not maintaining an adequate forecast management process,
- not offering program crop price elections that reflect regional price variation,
- not fully evaluating the costs associated with offering a high price election set at 100 percent of the forecast price, and
- not requiring a discount for unneeded harvest costs when the entire crop is lost.

How Longer Forecast Periods Affect Forecast Accuracy

Time periods for making and releasing price forecasts have recently been the subject of debate. An A&US official said that efforts have been made to release the initial forecasts earlier than July 1 for spring-planted crops. We concur with the Commission for the Improvement of the Federal Crop Insurance Program recommendation that price forecasts should not be released until 2 months prior to the insurance sales closing date.

We believe that developing the forecast at a later date could reduce forecast errors because a shorter forecast time period would reduce the chances for intervening events to affect forecast accuracy. We estimated that corn, soybeans, and wheat program costs increased about $12.6 million dollars during crop years 1983 to 1989 for each 0.5 percent increase in bias error.

Forecast Management

Our review of FCIC's forecasts indicates that substantial improvement is needed in FCIC's forecast management process.[1] Some improvements are now being made, but a major effort is needed to identify the source of forecasting errors, maintain data records, and document forecasting methods. Finally, FCIC needs to improve its forecast organization and quality control.

[1]The four initiatives for improving accuracy of price forecasts we consider critical for a forecast management process are those specified in the Food, Agriculture, Conservation, and Trade Act of 1990, section 2512. They are (1) identifying the source for forecasting errors, (2) maintaining data records, (3) documenting forecasting methods, and (4) correcting weaknesses in forecasting components.

Identifying the Source of Forecasting Errors

Sound forecast management requires comparing the crop price forecasts to actual reported results. We found that FCIC does not systematically or formally

- measure the accuracy of its forecasts,
- compare its price election forecasts to alternative benchmarks, or
- systematically validate existing forecast methods using such techniques as peer group review by USDA and outside experts.

With the exception of the Walt Hill study, we found no evidence that A&US staff systematically compared their forecasts to subsequent actual market prices. The results of the Hill study, however, were not provided to the A&US analysts. FCIC could not compare all price forecasts to actual prices since for many commodities, particularly specialty crops, there are no actual prices available. Neither the National Agricultural Statistics Service (NASS) nor any other public agency calculates actual prices for all the crops FCIC insures. This lack of actual specialty crop prices makes accuracy calculations or benchmark comparisons difficult. NASS estimated that a dramatic increase in funding would be required to collect price data for the specialty crops FCIC insures.[2] Benchmark comparisons to the published program crops, such as we demonstrate in appendix III, could be routinely made. Should FCIC continue to make program crop forecasts, it should consider using WAOB forecasts as a benchmark.

We noted that while FCIC analysts discussed price election forecasts with other experts, there was little formalized review of its forecast methodologies. An FCIC analyst said this is because few analysts outside FCIC could be helpful. Further, FCIC tends to rely on the professionalism of the A&US staff.

Maintaining Data Records

In crop year 1990, FCIC started maintaining a data base of all forecasts that it used as an operational tool for preparing actuarial documents. This data base does not include any information on actual prices. FCIC is also not recording special events that affect the input data or the forecast results. An events register could describe the effects of perils, FCIC-specific program changes, or political events such as trade sanctions and

[2]Specialty crops are crops for which WAOB does not forecast prices and include most of the crops other than the USDA-designated program crops.

wars.[3] Further, FCIC has not maintained a systematic record of input data such as program assumptions, economic assumptions, price and production trends, and other pertinent data in developing its input for the price election determinations.

An FCIC official said that FCIC does not document where it gets its price estimates since the private sector analysts are reluctant to release such information. An A&US official admitted that the lack of a special events register is a weakness for specialty crops such as peas or lentils. However, he said the Economic Research Service does produce situation reports that provide special-event information.

Documenting FCIC's Forecasting Methods

While A&US economists document some of the methods they use when they make their price forecast recommendations, documentation could be improved by preparing a manual of their forecast methodologies, including all major assumptions and other necessary information. Such a manual would be similar to the one that NASS developed and uses.[4] This would allow the replication of forecasts and their understanding in future years when the analysts who made the forecasts are no longer available. FCIC has made a start with the publication Price Election Process, but we believe that this publication should be expanded.[5]

Since much of FCIC's forecast methodology is not documented and cannot be replicated, FCIC management is limited in its ability to share the strengths of its forecasting processes with other analysts and in evaluating the quality of forecasts. Without full documentation of forecast methodologies, peer review is not possible.

An A&US official expressed concern about documenting the methods FCIC uses for making price forecasts since FCIC does not use econometric models or other predictive methods. Instead, it develops a synthesis of

[3]Perils are events that pose a risk of production loss and can include drought, flood, excessive rain, hail, frost, winter kill, snow, lightning, fire, wind, hurricane, tornado, wildlife, insect infestation, and plant disease. A method for developing an events register is discussed by W. L. Gorr, "Use of Special Event Data in Government Information Systems," Public Administration Review, 46 (November 1986), 532-39.

[4]USDA, Statistical Reporting Service, Scope and Methods of the Statistical Reporting Service, Misc. Pub. 1308 (Washington, D.C.: September 1983).

[5]USDA, Federal Crop Insurance Corporation, Price Election Process (Washington, D.C.: February 28, 1990).

informed experts. An A&US analyst said it relies on each analyst's professional expertise to ensure that the forecast methodology is appropriate and correct.

Organizational Weaknesses and Quality Control

FCIC can improve its organization and quality control by (1) establishing specific procedures for internal controls, (2) devoting greater resources to the forecasting process, (3) conducting routine self-assessments, and (4) requiring documentation for management changes.[6]

FCIC does not have a structured quality control program or agency regulations setting standards for evaluating its forecast methodology and results, data management, and documentation and reporting. FCIC's quality control is primarily attained through the use of professional staff and normal supervisory review. We recently addressed the need for improved internal controls when FCIC establishes new county crop programs.[7]

Walt Hill recommended that FCIC improve its price forecasting program by increasing its investment in both human and financial inputs. He recommended that the forecasting program be expanded and that a total of nine people work in the forecasting program.[8] Currently, fewer than 4 staff years are dedicated to forecasting. We recognize that additional staff, contract assistance, or a workload reprioritization may be required.

In 1987, FCIC did conduct a vulnerability assessment on A&US's internal controls. No further internal control work has been done since then. A&US officials said the 1987 assessment was a cursory effort and did not address the substantative issues such as rate setting or price forecasting that were involved in FCIC's major losses. Our review of the questionnaires confirmed this. The 1987 vulnerability assessment addressed such topics as time and attendance, procurement, imprest fund, travel, supplies and inventory, and a management checklist on such topics as

[6]Internal controls are the (1) objectives; (2) control procedures used to provide reasonable ensurance that goals and objectives are met; resources are adequately safeguarded and efficiently used; reliable data are obtained, maintained, and fairly disclosed in reports; and laws and regulations are complied with; (3) accounting system; and (4) management's monitoring system.

[7]U.S. General Accounting Office, Crop Insurance: FCIC's Internal Controls on Safflower Coverage Must Be Improved, GAO/PEMD-91-27 (Washington, D.C.: July 15, 1991).

[8]Walt Hill, "Analysis of the Federal Crop Insurance Corporation Price Election Procedure," report to the Federal Crop Insurance Corporation Manager, Washington, D.C., January 12, 1990, pp. 56-60.

training. FCIC is now considering another A&US vulnerability assessment for late 1991. Such assessments are traditionally required for all agencies by the Federal Managers' Financial Integrity Act of 1982 (Public Law 97-255). While FCIC was initially exempted from conducting these self-assessments, it is now required to submit these reports under the Chief Financial Officers Act of 1990 (Public Law 101-576). We believe that such self-assessments are particularly important when knowledgeable people assert that the FCIC ratemaking process is accountable for a major part of its multibillion dollar losses.[9]

Once A&US staff make forecasts, FCIC management must approve them. As we discussed in appendix III, we found that in 12 of the 21 corn, wheat, and soybeans forecasts reviewed, FCIC management increased the price forecast. No documentation exists for why those changes were made. We believe proper internal control dictates that the reasons for these changes be documented.

How Local Prices Vary From National Averages

Local prices can differ substantially from the national average prices. For this reason, FCIC now offers variable price elections, in some cases down to the county level, for some crops. The Commission for the Improvement of the Federal Crop Insurance Program recommended that these regional variations be considered whenever possible.[10] However, for most program crops, FCIC only offers price elections based on national seasonal average price forecasts.

We believe that when FCIC's national price elections exceed local prices, the potential exists for increased program costs and morale hazard. Conversely, when price elections are lower than what farmers perceive they can sell their crops for, participation in the program may decline. Thus, we believe it is important to consider local price variations.

ASCS compiles information on county sales prices for the various farm support program crops. It calculates "differentials" that are used to

[9]In Crop Insurance: Federal Crop Insurance Corporation Needs to Improve Decision Making, GAO/RCED-87-77 (Washington, D.C.: July 23, 1987), p. 71, we reported that actuary and underwriting activities are the major reasons for FCIC's losses. This issue was also highlighted in Nesterczuk and Associates, "Reforming Federal Crop Insurance: A New Approach to Risk Distribution," report to the Federal Crop Insurance Corporation Manager, Washington, D.C., December 15, 1989, p. ii.

[10]Commission for the Improvement of the Federal Crop Insurance Program, Findings and Recommendations (Washington, D.C.: July 1989), p. 52.

adjust loan rates for regional differences.[11] These differentials show the regional variations from the national seasonal average prices that NASS calculates. The differentials have been available since crop year 1988. FCIC could use ASCS differentials in setting price elections.

Table V.1 shows this variability in local prices. For example, for the first 6 months in crop year 1989, the average corn price was $2.36 in 3,046 counties; the minimum price was $1.86 and the maximum was $3.15. The minimum price was 79.0 percent of the average, while the maximum price was 133.7 percent of the average. Of the corn county prices, 1,330 were below the average. Of those 1,330 counties, the average price was 7.6 percent below the average. Five different varieties of wheat necessitate different differentials. Average prices varied from $3.50 to $3.87. Minimum prices varied from $3.07 to $3.39. Maximum prices varied from $4.26 to $5.14.

Table V.1: ASCS Crop Year 1989 Differentials Showing Variability in Local Prices for Corn, Wheat, and Soybeans

		Wheat					
	Corn	Durum	Hard red spring	Hard red winter	Soft red winter	White	Soybeans
Average[a]	$2.355	$3.495	$3.867	$3.810	$3.703	$3.845	$5.580
Minimum	$1.860	$3.070	$3.220	$3.250	$3.390	$3.150	$4.700
Maximum	$3.150	$4.530	$5.140	$4.630	$4.260	$4.520	$6.090
Number of counties	3,046	352	627	1,445	2,078	375	2,614
Percent minimum is of average	78.97%	87.84%	83.28%	85.30%	91.55%	81.92%	84.23%
Percent maximum is of average	133.74%	129.62%	132.93%	121.53%	115.05%	117.54%	109.14%

[a]The average county price uses an unweighted mean.

Source: ASCS, Commodity Analysis Division, crop year 1989 posted county prices.

Using ASCS differentials for calculating requires two methodological considerations: (1) how to calculate the average price and (2) whether to use the most recently available differential information or to calculate a moving average. We calculated prices using an unweighted mean for all county prices. Average prices, however, can be weighted using ASCS's calculated production for each county, the NASS calculated production, or the amount of insurance FCIC offers for that county. ASCS differentials

[11]Commodity prices must be adjusted for regional differences because of differences in the transportation costs to terminal markets and unique market characteristics in a county. Unique market characteristics can include, among other things, the number of warehouses located in a county. See U.S. General Accounting Office, Farm Payments: Evaluation of Changes in County Loan Rates, GAO/RCED-89-47BR (Washington, D.C.: February 15, 1989), p. 8.

are now available for crop years 1988-90, which allows calculation of a moving average differential.

Setting Price Elections Lower Than 100 Percent of Forecast Prices

Price elections at 100 percent of the forecast seasonal average price would result in losses higher than if lower price elections were selected. These higher losses would occur for at least two reasons: (1) higher price elections increase the total amount of indemnities and (2) morale hazard can increase when crops are insured for more than their selling price.

We analyzed the cost implications of using a high price election set at 90 percent of the anticipated seasonal average price for two reasons. First, for crop years 1983 to 1989, the legislation allowed FCIC to offer its highest price election at no lower than 90 percent of the seasonal average price. FCIC chose, however, to set its maximum price election at 100 percent of the anticipated seasonal average price. Second, on the average, the FCIC bias error rates overestimated corn and wheat price elections by 10 percent and 5.9 percent, respectively. This means that FCIC was in effect insuring above the actual seasonal average price.

The Cost Effect of Insuring at 90 Percent of Seasonal Average Price

As shown in table V.2, had FCIC set the maximum price election at 90 percent of the forecast seasonal average price, it could have saved $266 million in corn, wheat, and soybeans costs during crop years 1983 to 1989. The wheat price elections showed the most savings at $103 million, followed by corn and soybeans with savings of $73 million and $89 million.

Table V.2: Estimated Savings for Corn, Wheat, and Soybeans Crop Years 1983-89[a]

	Costs using		
Crop	FCIC forecasts	90% of FCIC forecasts	Savings
Corn	$725	$653	$73
Wheat	1,035	932	104
Soybeans	892	803	89
Total	**$2,652**	**$2,388**	**$266**

[a]Dollars in millions.

When price election levels are cut 10 percent, program costs and indemnities are reduced in a similar proportion. The net effect is $266 million in program cost savings.

Loss Ratios Sorted by Price Election

Table V.3 shows that for crop years 1983-89, loss ratios for the high price elections averaged 1.66. The low and medium price election loss ratios, however, averaged 0.96 and 0.86, respectively. Further analysis by individual crops indicates that for all three crops, loss ratios were lower for the low and medium price elections. FCIC sold relatively few low price election policies. About 95 percent of all federal program costs are for the high price election.

Table V.3: Premiums, Indemnities, Total Federal Costs, and Loss Ratios for Corn, Wheat, and Soybeans Sorted by Loss Ratio Crop Years 1983-89[a]

Price	Premium	Payments to producers (indemnity)	Total federal cost	Loss ratio
Low	$58.9	$56.5	$41.7	0.96
Medium	134.1	115.3	85.4	0.86
High	1,801.6	2,998.1	2,524.9	1.66
Total	**$1,994.6**	**$3,170.0**	**$2,652.0**	**1.59**

[a]Dollars in millions.

While the cause of these higher losses is not clear, FCIC officials and previous actuarial studies indicate that morale hazard can play a part. Morale hazard costs, by their very nature, are difficult to quantify.[12] For the purpose of this study, we did not try. However, Nesterczuk estimates that 31 percent of FCIC's excess loss ratio stems from adverse selection and underwriting problems, another 27 percent from program abuse.[13]

FCIC officials said they would study this issue further. They stressed, however, that the very preliminary analysis we conducted would have to be expanded. They stated that the number of medium and low price election policies was relatively small and that analysis of the yield election options would also have to be studied.

Harvest Costs Deductions

FCIC officials stated that current FCIC procedures do not fully address the reduction in indemnity payments when a total crop failure negates the need for harvesting. Total losses result in the insured's incurring no harvesting costs. Prior to 1980, FCIC calculated losses on the basis of different stages of crop production, including both harvested and

[12]Milliman and Robertson, Inc., "Actuarial Analysis of Multiple Peril Crop Insurance," study prepared for USDA, Federal Crop Insurance Corporation, Kansas City, Missouri, January 4, 1984, p. 9.

[13]Nesterczuk and Associates, p. 18.

unharvested stages of production. Currently, FCIC uses a different method that takes into account harvest costs when determining losses. The method, however, is used only for certain crops that have a high portion of total production costs, such as for tobacco, and not for all crops that are insured. Deductions for harvesting costs can be estimated with different methods. Three studies we identified showed that annual costs could range from $4 million to $38 million annually for corn, wheat, and soybeans.

Potential Cost Savings Associated With an Unharvested Acres Deduction

Potential savings vary widely depending on the assumptions used. Major assumptions involve (1) the number of unharvested acres, (2) the amount of the harvesting cost associated with a particular crop, and (3) the method used to adjust for FCIC's practice of accounting for production left in the fields. USDA's Office of Inspector General estimated that 1986 wheat and soybeans indemnity payments could be reduced by 5 percent if indemnity payments had been reduced by the harvest costs that the claimants never incurred.[14] This 5-percent cost factor, if applied to the 1983-89 indemnities of $2.2 billion, would result in nationwide savings of $15.7 million annually for soybeans and wheat. The cost estimate was based on a limited sample of policies from one state, as well as a limited evaluation of harvest costs.

A&US prepared a study to estimate the cost effect associated with harvest costs.[15] A&US estimated that the average annual additional indemnity costs for crop years 1986-89 were about $4 million. This study used FCIC's previous harvest cost deductions but considered the new FCIC practice of implicitly deducting any unharvested yield when calculating indemnity payments. Current FCIC practice is to deduct any yield left unharvested from the insured's coverage levels when calculating the indemnity. In some cases, the crop may not have been a total loss; instead, the farmer left some crop as uneconomic to harvest. For example, if the loss adjuster observed 5 bushels per acre left in the field, this was deducted when calculating the indemnity.

[14]USDA, Office of Inspector General, Audit of Federal Crop Insurance Corporation Reinsurance Operations—Mississippi, Number 05099-11-At (Washington, D.C.: March 31, 1988). The office recommended that FCIC study the issue of staged guarantees and amend crop insurance policies to provide for reduced indemnity payments at appropriate crop production stages, including the unharvested production stage. FCIC initially concurred with this recommendation but subsequently did not implement it.

[15]FCIC provided us with an internal study dated July 5, 1990, that showed that harvest costs in the southeastern United States varied from 22 percent (corn) to 82 percent (tobacco) of variable costs. FCIC estimated harvest costs ranged from $29 for corn to $23 for soybeans and $22 for wheat.

We used FCIC's unharvested acreage information and its new study estimating variable harvesting costs to calculate the effect of reestablishing the harvest cost deduction. We estimate that the annual additional indemnities for crop year 1986 through 1989 would be about $38 million yearly, assuming the harvested acre designation means a total loss.

Concerns About Applying the Unharvested Acres Deduction

An A&US official told us that there is a clear economic justification for some harvest cost adjustment but that calculating the specific cost amount to deduct is difficult for several reasons:

- reliable national harvest cost data are not available,
- FCIC already deducts from payments any potential yields on unharvested acres,
- the unharvested acres designator included in the experience data base may not be reliable since some of the reported yields are economic to harvest,
- insurance agents may not notify farmers of the harvest cost deduction, and
- some farmers incur harvest costs since they must plow under the unharvested crop in order to plant a different crop in the same land next season.

The A&US official also said that A&US considered that its study, which indicated that additional costs approximated $4 million annually, demonstrated that a significant amount of money was not involved. He said it was not worth the controversy to include this deduction. He said the practice was changed in the early 1980's as a way to increase participation.

Some Observations on What FCIC Should Do Now

The potential savings vary dramatically depending on the methodology used to develop the estimate, as well as the reliability of the FCIC experience data base. We believe all three costing methods need to be further evaluated to determine which approach should be considered. A random sample of policies could be assessed to estimate unharvested acreage designators and yields. Although it is not clear from available information which estimating method should be used, we believe that multimillion dollar savings are possible. Given FCIC's heavy loss position, deducting harvest costs should be considered.

Conclusions, Recommendations for Improving FCIC's Forecasting Program, and Agency Comments

In this appendix, we respond to evaluation question 3, "How can FCIC improve its forecasting accuracy?" In particular, we offer recommendations that should improve the accuracy of FCIC's price elections, as well as improve the actuarial soundness of its insurance program.

Conclusions

Use of Board Forecasts

We believe that FCIC should use WAOB forecasts because they have been shown to be more accurate. We wrote a letter of inquiry to the WAOB chairperson on December 18, 1990, explaining that FCIC was using forecasts not approved by WAOB for establishing price elections. The WAOB chairperson responded on January 15, 1991, stating that "we will review FCIC price forecasting procedures and requirements and we will inform you of any Departmental decisions on this matter." In their formal comments on a draft of our report, WAOB officials agreed that USDA's price forecasts "should be used where feasible to meet program needs such as those of FCIC."

We discussed the use of WAOB forecasts with A&US officials, who stated that they were willing to use the available forecasts if they are provided in time for the price election publications and OMB authorizes release of the price forecasts prior to when they are traditionally released in the budget documents. The WAOB chairperson told us that price forecasts are available for all program crops listed in appendix VIII, table VIII.2.[1]

Using Forecasts Closer to Sales Closing Date

We believe the Commission for the Improvement of the Federal Crop Insurance Program recommendation for later price announcements is appropriate. Deferring to a December 15 release date for spring crops should improve forecast accuracy. In a previous report, we found that as the time period between forecasts and actual prices increases, bias error tends to increase.[2] We believe this a typical finding and can be expected, since with a shorter forecast period, fewer events can affect

[1]USDA is prohibited by law from publishing price forecasts of cotton. (12 U.S.C. 1141j(d)).

[2]See U.S. General Accounting Office, USDA's Commodity Program: The Accuracy of Budget Forecasts, GAO/PEMD-88-8 (Washington, D.C.: April 21, 1988), pp. 59-73; Short-Term Forecasting: Accuracy of USDA's Forecasts and Estimates of Meat Production, Prices, and Inventories, GAO/PEMD-91-16 (Washington, D.C.: May 6, 1991), pp. 55-59; USDA Commodity Forecasts: Inaccuracies Found May Lead to Underestimates of Budget Outlays, GAO/PEMD-91-24 (Washington, D.C.: August 13, 1991).

forecast results. A&US officials agreed with our concerns, observing that FCIC has expressed concern about extending the forecast period too far.

Forecast Management

We believe that FCIC can improve the accuracy of its crop forecasts through improved management. The elements of a successful management program were identified in earlier GAO reports on USDA accuracy and reflected in the Food, Agriculture, Conservation, and Trade Act of 1990 (sec. 2512).[3] Forecast accuracy should improve if these steps are properly implemented. These elements include

- systematically identifying the source of forecasting errors by assessing the reasonableness of USDA's forecasts by measuring and reporting accuracy and comparing to benchmarks;
- maintaining records of data used for supply and utilization forecasts, including a data base of forecasts, special events, and input data;
- documenting forecasting methods for subsequent analysis, the methodologies used, all major assumptions, the forecasts made, and other information necessary to understand how they were made; and
- correcting weaknesses in its various forecasting components, including the establishment of a quality control program.

Differentials for Regional Price Variations

FCIC could use ASCS differential data to adjust for regional price differences. These data are readily available from and periodically updated by ASCS. FCIC now has a data base of price elections, which is used for automated posting of all price elections to all FCIC insurance publications. Thus, little administrative complexity would be involved in using the ASCS differentials for program crops.

Allowances for Staged Production and Harvest Costs

FCIC needs to conduct further work to identify what data are available on harvest costs (for example, by bushel or by percentage of total prices received) and on the total amount of FCIC's indemnified but unharvested land. Should an assessment of these data support the Inspector General's contention that as much as 20 percent of all indemnified land represents a total loss and harvest costs represent 20 percent or more of all costs, then adjustments seem in order.

[3]See the references in footnote 2. Our comments in those reports are based on a review of available research pertinent to managing a forecast process.

Recommendations to the FCIC Manager

We recommend the Manager for FCIC

- to the extent possible, use WAOB price forecasts that are available;
- determine the feasibility of using or making forecasts prepared no sooner than 2 months prior to insurance closing date;
- implement a stronger forecast management process;
- use price differentials for any crop where available;
- develop a more effective method for deducting harvest costs for insureds who have total losses and therefore do not have harvesting outlays.

Recommendations to the Assistant Secretary for Economics

The Assistant Secretary for Economics is responsible for supervising agencies such as the National Agricultural Statistics Service, WAOB, and the Economic Research Service (ERS). These agencies were established to prepare independent, objective analysis. The program agencies, such as FCIC, were then to implement USDA's programs. NASS has responsibility for preparing actual prices, WAOB coordinates the forecasts, and ERS prepares cost information based on the cost of returns survey.

We recommend that the Secretary of Agriculture direct the Assistant Secretary for Economics to assess the cost-effectiveness of initiating special crop forecasts and actual prices. We further recommend that WAOB make the forecasts and NASS prepare actual seasonal average prices for the crops that FCIC insures.

Agency Comments and Our Response

FCIC agreed with all our recommendations except for the one dealing with deductions for harvest costs. FCIC indicated that its current method for calculating losses does take into account "appraised production" and that it is the "best understood insurance practice" available. An assessment of different methods for calculating harvest costs on various insured crops has not been conducted, and FCIC's current method for taking into account deductions for harvesting costs does not apply to all insured crops. We believe that further study of methods for deducting harvesting costs should be conducted, particularly in light of the potential cost savings that may be realized.

Program and Cost Information

Table VII.1: Insured Counties and Crop Programs 1979-91

Calendar year	States	Counties	Crops	County programs	Annual additions: County programs	Annual additions: Crops
1979	39	1,526	29	4,063	[a]	[a]
1980	39	1,680	30	4,632	569	1
1981	40	1,928	30	5,969	1,337	0
1982	49	2,999	29	14,498	8,529	0
1983	49	3,000	32	15,415	917	3
1984	49	3,010	37	17,868	2,453	5
1985	49	3,012	39	18,892	1,024	2
1986	49	3,013	41	19,053	161	2
1987	49	3,014	42	19,263	210	1
1988	49	3,015	44	19,611	348	2
1989	50	3,019	49	20,507	896	5
1990	50	3,026	51	21,354	847	2
1991	50	3,026	51	21,373	19	0

[a]Base year data unavailable.

Source: FCIC, Program Planning and Evaluation Division.

Selected Crop Insurance Information for FCIC-Insured Crops

Table VIII.1: FCIC Crop Liabilities, Premiums, Subsidies, Indemnities, and Loss Ratios Crop Years 1983-89[a]

Crop	Liability	Total premium	Premium subsidy	Indemnity	Loss ratio
Program					
Barley	$1,082.1	$89.9	$21.3	$227.4	2.53
Corn	15,363.9	800.8	191.8	950.4	1.19
Cotton	2,141.9	227.6	63.7	351.8	1.55
Grain sorghum	1,172.1	93.2	23.6	187.9	2.02
Oats	159.9	15.4	4.0	39.5	2.57
Peanuts	2,474.3	131.6	27.7	230.5	1.75
Rice	413.9	12.4	2.7	34.9	2.83
Rye	1.9	0.2	0.1	0.2	1.15
Soybeans	9,467.3	645.0	146.4	1,080.9	1.68
Sugar beets	588.3	26.5	6.6	32.9	1.24
Sugar cane	103.3	5.6	1.2	14.4	2.58
Tobacco	4,502.0	130.3	24.8	186.8	1.43
Wheat	7,731.8	557.8	135.9	1,181.7	2.12
Subtotal	**$45,202.9**	**$2,736.3**	**$649.8**	**$4,519.5**	**1.65**
Other					
Almonds	$438.7	$28.7	$6.0	$39.8	1.38
Apple	266.8	25.4	6.2	48.0	1.89
Beans, dried	468.8	38.6	9.8	80.3	2.08
Canning beans	7.2	0.6	0.2	0.9	1.47
Canning peaches	11.0	0.8	0.2	0.6	0.70
Citrus	207.1	17.9	4.6	23.5	1.32
Citrus trees	166.5	6.9	1.8	19.1	2.77
Combined crop	42.4	1.4	0.3	0.9	0.61
Cranberries	90.2	2.7	0.7	3.8	1.39
Figs	5.3	0.5	0.1	0.5	1.00
Flax	22.2	2.7	0.7	4.6	1.72
Forage production	38.5	1.8	0.5	4.7	2.60
Fresh market sweet corn	34.4	1.9	0.5	2.8	1.48
Fresh market tomatoes	242.2	21.3	4.9	29.7	1.40
Grapes	299.8	20.1	4.2	23.0	1.14
Green peas	64.3	5.7	1.5	6.3	1.12
Hybrid corn seed	622.5	42.8	9.6	72.1	1.69
Hybrid sorghum seed	2.4	0.3	0.1	1.2	3.72
Macadamia nuts and trees	36.1	0.5	0.1	0	0
Nursery	2.6	0.1	0	0.1	1.19
Onion	10.4	0.7	0.2	1.7	2.60
Peaches, fresh	97.3	10.3	3.0	27.2	2.65

(continued)

Crop	Liability	Total premium	Premium subsidy	Indemnity	Loss ratio
Pears	1.7	0.1	0	0	0.01
Peas, dried	32.9	2.3	0.5	1.5	0.66
Peppers	45.0	4.3	1.0	5.6	1.29
Popcorn	52.7	3.1	0.7	5.3	1.70
Potatoes	585.7	30.6	7.2	81.5	2.66
Prevented planting	2.0	0.1	0	0.2	0.45
Prunes	41.0	2.6	0.6	5.2	1.97
Raisins	912.6	79.8	20.3	62.7	0.78
Safflower	5.7	0.5	0.1	1.7	3.29
Stone fruit	10.2	0.8	0.2	0.6	0.77
Sunflowers	345.3	29.0	7.5	55.7	1.92
Sweet corn	66.9	4.0	1.0	3.7	0.92
Table grapes	78.9	6.2	1.4	9.3	1.51
Tomatoes	383.5	24.1	5.5	22.2	0.92
Walnuts	13.0	0.7	0.1	0.8	1.13
Subtotal	**$5,754.0**	**$419.8**	**$101.3**	**646.8**	**1.54**
Total	**$50,956.7**	**$3,156.1**	**$751.1**	**$5,166.3**	**1.64**

[a]Dollars in millions. Totals do not add because of rounding.
Source: FCIC, A&US experience data base.

Table VIII.2: Crop Liabilities, Premiums, Subsidies, Indemnities, and Loss Ratios by State Crop Years 1983-89[a]

State	Liability	Premium	Subsidy	Indemnity	Computed loss ratio
Alabama	$817.4	$58.4	$12.5	$111.4	1.91
Alaska	1.4	0.3	0.1	0.3	0.97
Arizona	80.9	4.1	0.8	6.0	1.47
Arkansas	730.0	76.8	15.8	180.3	2.35
California	2,390.1	177.2	41.2	182.6	1.03
Colorado	485.5	47.2	13.3	47.0	0.99
Connecticut	14.1	0.7	0.2	1.0	1.51
Delaware	38.5	2.7	0.7	4.3	1.63
Florida	706.9	53.7	12.6	79.5	1.48
Georgia	1,767.3	114.3	24.2	212.1	1.85
Hawaii	36.1	0.5	0.1	0	0
Idaho	413.5	24.3	5.1	48.1	1.98
Illinois	3,475.1	147.8	32.0	227.1	1.54
Indiana	1,502.8	68.8	15.0	95.1	1.38
Iowa	7,977.2	339.5	74.1	361.0	1.06
Kansas	1,836.1	139.0	36.7	250.5	1.80
Kentucky	796.4	39.5	8.0	66.8	1.69
Louisiana	596.0	66.6	15.5	177.8	2.67
Maine	64.7	3.9	0.8	6.3	1.62
Maryland	60.1	4.0	0.9	6.9	1.74
Massachusetts	23.4	1.0	0.3	1.5	1.45
Michigan	334.3	21.7	5.6	57.9	2.67
Minnesota	3,922.5	227.4	59.1	223.7	0.98
Mississippi	634.4	64.8	13.7	168.9	2.61
Missouri	1,313.4	108.9	27.8	172.4	1.58
Montana	1,822.5	139.4	28.8	465.7	3.34
Nebraska	3,805.3	213.7	54.0	214.8	1.01
Nevada	0.9	0.1	0	0.3	5.92
New Hampshire	0.3	0	0	0	0.88
New Jersey	17.5	1.9	0.5	4.3	2.31
New Mexico	54.1	6.4	1.7	11.8	1.84
New York	58.7	3.7	0.9	5.6	1.51
North Carolina	3,281.1	121.0	24.3	174.8	1.44
North Dakota	3,353.6	246.6	63.0	520.3	2.11
Ohio	718.8	34.1	7.6	47.3	1.39
Oklahoma	531.3	41.5	10.2	79.5	1.92
Oregon	258.3	10.1	2.1	8.3	0.82
Pennsylvania	99.9	7.0	1.8	8.0	1.14

(continued)

State	Liability	Premium	Subsidy	Indemnity	Computed loss ratio
Rhode Island	1.8	0.1	0	0.2	1.66
South Carolina	738.0	43.6	10.1	71.3	1.63
South Dakota	971.2	87.5	24.6	121.8	1.39
Tennessee	167.2	12.2	2.6	21.1	1.73
Texas	2,733.3	273.6	75.9	555.8	2.03
Utah	20.4	2.0	0.4	4.8	2.44
Vermont	5.5	0.6	0.1	0.5	0.93
Virginia	773.0	36.5	8.0	67.3	1.84
Washington	918.9	44.8	8.9	48.3	1.08
West Virginia	12.5	1.0	0.3	2.9	2.88
Wisconsin	480.5	28.6	7.8	30.3	1.06
Wyoming	113.9	7.1	1.6	12.9	1.83
	$50,956.6	$3,156.1	$751.1	$5,166.2	1.64

[a]Dollars in millions.

Source: FCIC, A&US experience data base.

Price Forecast Accuracy Measures

In this appendix, we address how the accuracy of forecasts can be measured. We present formulas for measuring forecast accuracy. The concepts and formulas are drawn from the work of forecasting experts such as Armstrong, Ascher, Makridakis, and Bretschneider and from our previous forecast evaluations.[1] As discussed below, we use a series of summary error measures to indicate the magnitude of total error and to identify bias error.

The Concept of Error

For a single forecast, the difference between the forecast (F) and the actual (A) value is the error (E); that is, E = A -F. The single forecast error may be positive or negative. It does not have much value for gauging the quality of a forecasting model, but multiple forecasts made over varied times can be used to show how accurately a forecasting procedure is working. Calculated in this way, negative errors are overestimates, while positive errors are underestimates.

To analyze forecasting methods, the single forecast error can be separated into two parts. One part is called "random error" and it varies unsystematically from one forecast to the next. The other part is called "bias error" and it remains constant for any particular forecasting procedure.

For complex models, bias error can come from any of the input variables or component forecasts and generally varies with each single forecast in a time series. Bias error can result from many factors, including problems of design, methodology, measurement instruments, input data, or conscious or unconscious subjectivity on the part of the analyst.

The length of the time series or the number of data points affects the statistical validity of the measurements. According to a USDA official, a minimum time period needed for evaluating forecast accuracy may very well be 20 years. However, we do not believe that the evaluation of forecasts can always be put off until sufficient time exists to make statistically accurate measurements. Timely evaluations are needed to improve the forecasts' credibility and to ensure that decisionmakers get the information they need.

[1] J. Scott Armstrong, Long-Range Forecasting: From Crystal Ball to Computer, 2nd ed. (New York: John Wiley and Sons, 1985); William Ascher, Forecasting: An Appraisal for Policymakers and Planners (Baltimore: John Hopkins University Press, 1978); Spyros Makridakis et al., The Forecasting Accuracy of Major Time-Series Methods (New York: John Wiley and Sons, 1984); Stuart Bretschneider, personal communication, and "Forecasting: Some New Realities," Metropolitan Studies Program, Syracuse University, Syracuse, New York, December 1985.

In analyzing error in multiple forecasts, we concentrated on absolute error measures and bias error measures. We refer to the absolute error measures as total error, which is the sum of random and bias error. It is important to measure bias error because research has shown that its causes can frequently be isolated and corrected.

Measures of Single Forecast Error

The basic error measurements are for one forecast at a time. These measurements stress identifying the deviation between the actual data and the forecast. In all cases, the actual serves as the base, the forecast being deducted. To reiterate, the error (E) is defined as E = A - F, or the difference between A and F.

Individual percentage error (IPE) is defined as IPE = (E/A) x 100; it is error divided by the actual value multiplied by 100. The measure shows whether the error is negative or positive. The percentage error measurement favors forecasts that are less than the actual, or underestimates. If the forecast is less, the error cannot exceed 100 percent, but the percentage error for overestimates has no limits.

Summary Error Measures

The sum of the two components of forecast error—random and bias error—is "total error." Total error is measured with absolute measures (that is, negative and positive signs are not considered). Measurement of the random and bias error components, however, involves consideration of the negative and positive signs of single errors over time. These two partially offset each other, thus canceling out random error that is unavoidable and identifying bias error that can be reduced. Research has shown that the causes of bias error can frequently be isolated and corrected.

In analyzing error in multiple forecasts, we concentrated on total error and bias error measures. The first step in developing summary error measures is to subtract the individual forecast or estimate from the actual. The difference is the error. For single instances of error, the bias error component cannot be separated from the random component. However, multiple instances of error over time can be used to identify bias error.

To measure total and bias error, we used percentage error measures that express the error (actual minus the forecast or estimate) as a percentage of actual. Percentage error measures allow comparisons between forecasts or estimates of different quantities such as production and price,

as well as comparisons of forecasts or estimates of price over time. Analysis using percentage error allows us to give all observations equal weight. This is important since USDA uses similar forecasting methodologies from one year to the next. Averages calculated with other units, such as dollars or bushels, give greater weight to years in which the units are larger.

Measures of Total Error

Absolute measures over multiple forecasts show total error. Total, or absolute, error measures over a time series of forecasts ($F_1, F_2, \ldots, F_n$) divided by actual observations ($A_1, A_2, \ldots, A_n$) is referred to as the mean absolute percentage error, defined as

$$\text{MAPE} = \left(\frac{\sum_{i=1}^{n} \frac{|E_i|}{A_i}}{n} \right) \times 100$$

or the sum of the absolute percentage errors (absolute error for each forecast divided by actual observations) divided by the number of forecasts. The result is multiplied by 100. Mean absolute percentage error is dimensionless and useful for comparing forecasts from different situations. The measurement favors forecasts that are less than the actual in the sense that a low forecast can never be wrong by more than 100 percent, but the percentage error on the high side has no limit.

Measures of Bias Error

Bias error measures identify consistent underestimates and overestimates. It is important to identify bias error, because it happens when factors other than the random events are influencing the forecasts. It may be possible to make changes in the forecasting process that lessen bias error. Bias error must be measured over several observations to avoid mistaking it for random error. Bias error measures include mean percentage error, trimmed mean percentage error, and weighted mean percentage error.

Mean percentage error is defined as

$$\text{MPE} = \left(\frac{\sum_{i=1}^{n} \frac{E_i}{A_i}}{n} \right) \times 100$$

It is the sum of the percentage errors, whether underestimates or overestimates, divided by the number of forecasts and multiplied by 100. This measure favors estimates that are less than the actual. An underestimate can never be wrong by more than 100 percent (when the forecast is not less than 0), but the percentage error on the high side has no limit.

Benchmarks

Producing error-free forecasts is not possible given that most forecasts are based on uncertain knowledge about the future. However, total and bias errors alone are not enough to determine the reasonableness of forecast accuracy. What is missing is a basis for comparison. One way to evaluate the reasonableness of forecast accuracy is by comparing them with other forecasts, or benchmarks, to determine whether lower errors can be produced. For example, a forecast with an error of 40 percent may not be unreasonable if the next best forecast has an error of 50 percent. Benchmarks should start with simple, low-cost naive models.

Two types of benchmarks may be available: competitive and naive. Competitive forecasts are simply other forecasts used for comparison purposes. Individual forecasts can be used for this purpose, or they can be combined into a consensus forecast. Consensus forecasts can be combined as means, trimmed means, or weighted means.

Naive forecasts are derived from historical information with little or no judgment that the future will closely resemble the past. The simplest naive models use the latest actual value as the forecast. Another form of naive forecast would be to draw a straight line through points representing historical production, forecasting future production by extending the line to a future point.

Benchmark forecasts made with naive models or consensus methods can provide two types of checks. First, they help establish acceptable error and bias error rates for a specific type of forecast. For example, one agriculture forecaster considers error rates greater than those of a naive model to be unacceptable, believing that a reasonable goal for errors may be three fourths or less of the number generated by a naive model.[2] Second, benchmarks provide a means of questioning the methodology being used to generate forecasts. If postanalysis shows that comparison forecasts are more accurate over time, then the methodology being used needs to be reexamined carefully.

[2]John Ferris, "Evaluation of Forecasts from the Annual AAEA Outlook Survey," presented at the annual meeting of the American Agricultural Economics Association, Reno, Nevada, July 1986.

FCIC Official Comments

United States Department of Agriculture | Federal Crop Insurance Corporation | Office of The Manager | Washington, D.C. 20250

AUG 2 1 1991

TO: Eleanor Chelimsky, Assistant Comptroller General
Program Evaluation and Methodology Division; GAO

FROM: Manager

SUBJECT: GAO Draft Report PEMD-91-28, "CROP INSURANCE: Inaccurate FCIC Price Forecasts Increase Program Costs"

GENERAL COMMENTS:

FCIC:

Throughout the report, GAO recognized the difficulty for FCIC in attempting to provide price estimates many months in advance of unpredictable events such as severe weather and changing government programs that heavily impact FCIC's efforts. Further, GAO recognized FCIC's limited resources in this area. With these constraints in mind, GAO's primary recommendation of using other USDA crop price forecasts is an approach supported by FCIC.

WAOB/NASS:

We note that GAO's analysis of FCIC price forecasts covers 7 years of annual data, a period too short to yield confident results. Thus, while the calculations may offer a basis for hypotheses about the accuracy of different forecasting approaches, the results are not very reliable.

GAO Recommendation To FCIC:

1-- to the extent possible, use available Board crop price forecasts because they have been shown to be more accurate.

2-- determine the feasibility of using or making forecasts prepared late in the year, closer to the insurance closing date.

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GAO/PEMD

FCIC Response:

FCIC has explored these recommendations with members of the USDA Interagency Commodity Estimates Committees. FCIC will request that USDA consider adding a FCIC representative to these committees. In the interim, FCIC will meet with members to explore specific crops, processes, and release schedules that will be amenable to FCIC's crop program responsibilities. The working relationship of agencies should be beneficial to USDA. Possible price estimate improvement for FCIC and added committee strength in specialty crops where FCIC has developed strong relationships with grower, broker, and processor groups could be achieved. These proposed actions should address these two recommendations.

WAOB/NASS Response:

WAOB agrees that USDA price forecasts, prepared as part of the Department's regular analyses, should be used where feasible to meet program needs such as those of FCIC. Price forecasts and projections prepared for budget use under WAOB auspices include specific crop year forecasts for major program crops. WAOB wishes to cooperate in making that information available for FCIC use, and discussions are in progress with FCIC to assure that proper procedures are established.

The report notes that the WAOB has "primary responsibility for overseeing ... USDA commodity supply and demand forecasts." It then indicates concern that FCIC "prepares price forecasts independent of the Board." WAOB expects the current FCIC review of procedures, with which the Board is cooperating, to provide the proper basis for response to this concern. However, the Board's responsibilities for price forecasting are related to the Department's work on situation and outlook and to long-range projections. These responsibilities do not currently include preparation of information required for implementation of programs such as those of FCIC.

3-- use price differentials for any crop where available.

FCIC Response:

FCIC believes this recommendation requires further study before considering implementation. Price differentials by county as suggested by GAO are currently available from ASCS for a limited number of crops in the FCIC program. FCIC must evaluate the accuracy of these differentials, the cost to publish and file much larger numbers of actuarial documents, the cost to maintain the insureds database for the additional county prices, the additional cost for agents and companies selling and servicing the policies, and probable error rate increase in document processing.

FCIC will need to explore the overall administrative and commission expense impacts with both USDA and the crop insurance industry before committing to adoption. GAO does not provide an estimate of cost impact for this recommendation in the report and noted that potential savings were not quantifiable. Therefore, both potential costs and savings will need to be developed by FCIC.

4-- implement a stronger forecast management process.

FCIC acknowledges the appropriateness of the tasks included in this recommendation and believes the implementation of the two prior recommendations will be complementary to this recommendation.

5-- develop a more effective method for deducting harvest costs for participants who have total losses yet do not have to harvest a crop.

FCIC does not agree with this recommendation as it does not seem to follow the intent of the crop insurance changes that were initiated in 1980. Prior to 1980, losses were paid on a staging basis, i.e., substitute crop staging, unharvested staging, harvested staging. This follows the directive of the pre-1980 legislation which was directed at cost of production. This former method of staging crops was confusing since the insured had as many as 3 different levels of coverage on the same growing crop. We would not recommend returning to this method.

The 1980 amendment deleted references to cost of production and provided that insurance should be made available at various levels. The statute requires that the Corporation provide levels of yield coverage, including a level of coverage of 50 percent of the average yield. No mention was made of reducing indemnity payments by deducting harvesting costs not incurred in connenction with unharvested acreage. Prior to these changes, the Corporation received numerous complaints from producers when deductions were made in connection with unharvested acreage as the insureds were experiencing the most severe loss possible.

In determining crop insurance losses appraised production is taken into account when the producer decides not to harvest a crop with little yield. We believe that structuring the insurance under the current method is the best understood insurance practice. Rate adjustments are made which do reflect the expected losses without the deduction in connection with unharvested acreage.

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GAO Recommendation To Assistant Secretary for Economics:

-- assess the cost-effectiveness of conducting additional forecasts and determining actual crop prices on specialty crops for which such information is currently not available. The Board should make the forecasts and the National Agricultural Statistics Service (NASS) should prepare actual seasonal average prices for crops which FCIC insures.

NASS and WAOB are willing to work with the FCIC to prepare such an assessment. NASS prepares seasonal average prices for some 90 crops including fruits, vegetables, and nuts. The 51 crops for which FCIC provides insurance coverage are among these 90 crops. NASS price data for most fruits, vegetables, and nuts by state are not available until January following the crop year. To the extent that FCIC needs price data for different crop uses, more current, and at a more local level, additional funding would be needed. The additional funding requirement could be significant since grower surveys would likely be necessary for many specialty crops.

(Please note that editorial comments are not in response to this report but are attached as an addendum.)

If you have any further questions in response to the subject report, please do not hesitate to contact this office.

James E Cason

James E. Cason
Manager

CONCURRENCE: _____
Roland R. Vautour, Under Secretary
Small Community & Rural Development

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CONCURRENCE: James R. Donald
James R. Donald, Chairperson, WAOB — 8/14/91 Date

CONCURRENCE: Charles E Caudill
Charles E. Caudill, Administrator, NASS — 8/14/91 Date

CONCURRENCE:
Stephen B. Dewhurst, Director, OMPA — 8/16/91 Date

CONCURRENCE: James Michael Kelly Acting General Counsel
Alan Charles Raul, General Counsel, OGC — 8/19/91 Date

CONCURRENCE: Bruce Gardner
Bruce Gardner, Assistant Secretary for Economics — 8/21/91 Date

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Editorial Comments:

Pages 18 & 19 - Administrative expenses are included under program cost on page 18, in the text and in footnote 7; but they are excluded in the table on page 19. Why shouldn't program costs be defined the same way in both places?

Page 39 - The report overstates the evidence here by saying that Board forecasts tended to exhibit smaller bias and similar total error for all three crops. That description can be used for corn and wheat; however, for soybeans, the results are quite similar.

Page 57 - The 5 classes of wheat as shown in the table appear to have the terminology a bit mixed up. The classes are normally listed as follows: Hard red winter, Soft red winter, Hard red spring, white, and durum.

Page 59 - The column heading in the table shown as "Board Costs" is incorrect. The column appears to give the data for 90 percent of forecast price.

Major Contributors to This Report

Program Evaluation and Methodology Division	Richard T. Barnes, Assistant Director John E. Oppenheim, Assignment Manager
Kansas City Regional Office	David R. Solenberger, Regional Management Representative Fredrick C. Light, Project Manager Ruth Anne Decker, Evaluator

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Glossary

Accuracy	Measures the difference between an actual subsequent event and an initial forecast.
Actuarially Sound	An actuarially sound program, as required by the Federal Crop Insurance Act of 1980, calls for the crop insurance program premiums to be sufficient to cover all loss claims and establish a reserve for unforeseen losses. Nesterczuk and Associates define it as breaking even on a national basis over a 10-year period 85 percent of the time, excluding losses attributable to catastrophe.
Actuary	A person who computes premium rates, dividends, and risks according to probabilities based on statistical records.
Adverse Selection	A condition in which producers entering a program have a greater-than-average probability of experiencing losses. Producers who are riskier than average are more likely to take insurance, but individuals less risky than average are less willing to take insurance.
Benchmark	An alternative forecast used to compare to the accuracy of the original forecast. Benchmark forecasts should be low-cost, simple alternatives.
Bias Error	Describes consistent under- or overestimation of the actual indicator.
County Crop Programs	The number of crop programs offered in all counties. For example, if County A offers crop insurance for 4 crops and County B for 6 crops, then the total number of county crop programs would be 10.
Coverage Level	Percentage of yield guaranteed under FCIC insurance program. Elections are 50, 65, or 75 percent of assigned yields.
Crop or Marketing Year	The year in which a crop is harvested and marketed. For wheat, the crop or marketing year is from June 1 to May 31. For corn and soybeans, the crop or marketing year is from September 1 to August 31.

Error	The forecast subtracted from the actual result.
Forecast	The prediction of what will happen in the future, given some continuation or modification of present trends.
Guarantee	The financial liability to the policyholder. Maximum amount per acre the insured can receive, assuming a total loss. This is the price election multiplied by the approved yield multiplied by the yield coverage percent multiplied by share of insurable interest. See also Liability.
Hazard	Anything that increases the likelihood of loss.
Indemnity	The payment to an insured for losses covered under the crop insurance policy.
Insurance	A mechanism used by participants, known as insureds, to transfer risks. The business of transfer of pure risk by means of a two-party contract.
Internal Controls	The (1) objectives; (2) control procedures used to provide reasonable ensurance that goals and objectives are met; resources are adequately safeguarded and efficiently used; reliable data are obtained, maintained, and fairly disclosed in reports; and laws and regulations are complied with; (3) accounting system; and (4) management's monitoring system.
Liability	The maximum amount per acre an insurance company has to pay, assuming a full loss. This is the price election multiplied by the assigned yield multiplied by the yield coverage level multiplied by the crop share of the insured. Same amount as the Guarantee.
Loss	Reduction in the production of a crop as a result of a covered peril or hazard.

Loss Ratio	Ratio of the indemnities divided by the total (federal and producer) premium payments.
Moral Hazard	A condition in which actions of an insured increase the likelihood of a loss or the amount of the payment.
Morale Hazard	A condition in which an absence of incentives to minimize losses occurs once an insured has a legitimate claim. This can occur when a farmer has a partial loss on a crop and does not try to prevent further loss, because the insurance benefits are higher than the receipts from harvesting the crop.
Percentage Error	The result of the forecast subtracted from the actual result, which is then divided by actual result. The result is then multiplied by 100.
Peril	An event that produces a loss of crop production. For crop insurance, can include drought, flood, excessive rain, hail, frost, snow, winter kill, lightning, fire, wind, hurricane, tornado, wildlife, insect infestation, and plant disease.
Premium	The amount paid by the insured for coverage. Includes producer payment as well as federal subsidy.
Price Election	The selection of one of three price options offered (low, medium, and high), by an insured farmer, to determine the dollar value of insurance coverage. Effective for the 1992 crop year, insureds may select a price election from 30 to 100 percent of the price election shown in the actuarial documents. The high elections at 100 percent of seasonal average price forecast.
Program Costs	The major federal costs associated with the FCIC program, including reinsurance administrative expenses, master marketer commission fees, premium subsidies, and losses.

Program Crops	USDA-designated crops for which a loan rate, target price, allotment, and deficiency payment rate exist. Major crops meeting such criteria include barley, corn, cotton, grain sorghum, oats, peanuts, rice, rye, soybeans, sugar beets, sugar cane, tobacco, and wheat.
Random Error	The difference between total error and bias error. Random error is unavoidable and represents the minimum possible error.
Reasonable Error	Reasonable implies that no better forecasts are readily available.
Risk	Chance of loss.
Seasonal Average Price	The national weighted average market price of a commodity sold during the 12 months of a marketing year.
Supply and Utilization	Supply is the total availability of a commodity and consists of beginning stocks, production, and imports. Forecasts for supply are prepared for both U.S. and worldwide production. Utilization is the total of the amount exported, the amount used domestically for livestock feed, the amount used domestically for food and other products, and ending stocks.
Total Error	The sum of bias and random error.
Underwriting	To assume liability to the extent of a specified sum by way of insurance.

Related GAO Products

USDA Commodity Forecasts: Inaccuracies Found May Lead to Underestimates of Budget Outlays (GAO/PEMD-91-24, Aug. 13, 1991).

Crop Insurance: FCIC's Internal Controls on Safflower Coverage Must Be Improved (GAO/PEMD-91-27, July 15, 1991).

Short-Term Forecasting: Accuracy of USDA's Meat Forecasts and Estimates (GAO/PEMD-91-16, May 6, 1991).

Crop Insurance, Private Company Loss Adjustment Improving, but Overpayments Still High (GAO/RCED-90-32, Nov. 7, 1989).

Disaster Assistance: Crop Insurance Can Provide Assistance More Effectively Than Other Programs (GAO/RCED-89-211, Sept. 20, 1989).

Crop Production: Outlook for Post-Drought Recovery During 1989 (GAO/RCED-89-161BR, June 6, 1989).

Farm Payments: Evaluation of Changes in County Loan Rates (GAO/RCED-89-47BR, Feb. 15, 1989).

Crop Insurance: FCIC Should Strengthen Actual Production History Program Controls (GAO/RCED-89-19, Dec. 15, 1988).

Crop Insurance: Overpayment of Claims by Private Companies Costs the Government Millions (GAO/RCED-88-7, Nov. 1987).

Crop Insurance: Federal Crop Insurance Corporation Needs to Improve Decision Making (GAO/RCED-87-77, July 23, 1987).

Preliminary Results of GAO's Review of the Department of Agriculture's Federal Crop Insurance Program (GAO/T Ascension Number 131061, Sept. 23, 1986).

Farm Payments and Loans: Consistency Needed in USDA Crop Yield Estimates (GAO/RCED-86-118, May 29, 1986).

More Attention Needed in Key Areas of the Expanded Crop Insurance Program (GAO/RCED-84-65, Mar. 14, 1984).